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STUDY TO IDENTIFY STRESS CORROSION PRONE PARTS ON THE TA-7C AIR--ETC(U)

OCT 77 O H COOK N62269-76-C-0353

UNCLASSIFIED 2-53400/7R-3428 NL

1 OF 2

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MATERIAL INSPECTION AND RECEIVING REPORT

CONTINUATION SHEET

N62269-76-C-0353

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Cadmium Embrittlement
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Residual Stress

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This program was aimed at determining which parts in the TA-7C aircraft are prone to stress corrosion cracking, and then establish corrective measures encompassing: (1) inspection criteria including NDI methods and intervals, (2) protection improvements, (3) material changes, and (4) design changes. → next page

(continued)

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20. Abstract (continued)

The first task was the establishment of a stress corrosion cracking rating system based on evaluation parameters such as alloy/temper, product form, thickness, grain direction, protective systems, assembly and applied stresses and other influencing factors. This rating was tested for sensitivity relative to known failures. The ratings are presented in three forms: (1) Numeric, (2) Criticality, and (3) Stress Corrosion-Failure Probability.

The second task was to survey select stress corrosion cracking prone parts for measurement of residual stresses in suspect locations. Measurements were made within the stress analyzer physical limitations, and these measured stress values correlated with calculated stress.

The third task was to recommend inspection procedures and intervals, protective system changes, material/temper changes, and design changes. These are incorporated in the rating lists as a guideline to corrective action.

FOREWORD

This Final Technical Report covers work performed under Contract N62269-76-C-0353.

This contract with Vought Corporation was under the technical direction of Mr. I. Shaffer, NADC 30221, of the Naval Air Development Center, Warminster, Pennsylvania 18974.

Principal Investigator was Mr. O. H. Cook. Valuable contributions were made by the following:

Materials & Processes Evaluation - Messrs. J. H. Brouse and A. E. Hohman

Residual Stress Analysis - Mr. W. W. Ladyman

Structures Design Evaluation - Messrs. J. G. Williams and D. Devitt

Engineering Maintenance - Mr. E. J. Brej

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

BACKGROUND

During the life of all Naval aircraft historically there has been a "guaranteed" stress corrosion cracking (SCC) pattern develop. As the aircraft is exposed to the severe marine environment, corrosion becomes increasingly evident. Pitting then occurs where the protective system is damaged in any way. The sustained tension stress from aircraft loads, heat treatment stress, assembly stress, or any combination of these and other stress coupled with the corrosion then exceeds the SCC threshold for a material. Because of good protective systems and continuing maintenance it may take many months of service before circumstances are conducive to failure.

OBJECTIVE

The objective of this investigation is to identify all A-7A/B/C airframe components used in the TA-7C aircraft conversion that are susceptible to stress corrosion cracking (SCC) and establish corrective measures encompassing:

- inspection criteria for all levels of maintenance and NDI techniques,
- protection improvements,
- material/heat treat condition changes,
- design changes.

SCOPE

This program studies all 7075 (except sheet and T73 and T76 tempers), 7079, 7178, 2024, and 2014 aluminum parts, all low alloy steel parts heat treated to 200 KSI and above and all titanium parts in contact with cadmium plating and exposed to temperatures above 250^{o}F.

A rating system was developed considering the parameters affectint the occurrence of SCC (stress corrosion cracking). These include alloy/temper, product form, thickness, grain direction, protective systems, shot peening, assembly, and applied sustained stresses and crystallographic orientation. To test the rating system, a correlation was made using NARF and Vought failure history of A-7 airframe components.

Selected parts from the "most susceptible" group were reviewed to determine the surface residual stresses by calculation and verified by using a residual stress analyzer. The final task includes recommendations for handling the susceptible parts to eliminate stress corrosion cracking.

2.0 RATING SYSTEM

INTRODUCTION

Rating systems were established for screening aluminum and steel parts. The approach to developing this system is outlined below. The beginning or starting point in both systems was to start with aluminum alloy/temper or steel alloy/strength levels that are susceptible to stress corrosion cracking. The first screening was made from an A-7 and TA-7C computer analysis isolating 7075, 7079, 2014, 2024, and 7178 parts excluding sheet and the 7075-T73 temper for aluminum alloys and all 4340, maraging 280, 17-4PH, 15-5PH, 17-7PH steel parts.

The rating system was then applied to this list using two basic evaluations - Materials and Processes and Stress.

MATERIALS AND PROCESSES RATING

The rating sequence started with the initial materials and process screening. Those parts receiving a total rating of 50 points or more were held for further rating of protective factors. The numerical ratings for protective treatments were tabulated and subtracted from the first rating number. If the final rating number exceeded 50 points, the part was a candidate for further study. The stress evaluation was then applied and the numerical values added to the materials and process numbers. The parts which totaled over 80 points were then considered susceptible to stress corrosion cracking. A discussion of these systems follows.

The aluminum and steel alloy rating system was developed from: (a) studies of failure history on the F-8, S3A, and A-7 series aircraft; (b) rating system data developed for the Navy by another aerospace manufacturer; and (c) industry experience. The main objective was to isolate the parts that are most susceptible due to manufacturing history, design, environment, protection, and function. The following breakdown covers the aluminum system.

Aluminum

Alloy and Temper - The alloy and temper 7075-T73 was selected as a starting base, because of its excellent service history. The relative susceptibility of the other alloy/temper combinations were weighed

against this base and a numerical rating factor assigned. These factors are tabulated in Table I.

The materials factor was heavily weighed since the alloys 2014, 7075, 7079, and 7178 all have low stress corrosion cracking thresholds and experience shows them as the main culprits. In addition they were weighted according to propensity for SCC with 7079 and 7178 at 25, 7075 at 20, and 2014 at 10.

Size - The size or initial thickness aspect was weighted from 10 on large sizes down to 4 on smaller sizes. Consideration was given to product form weighting relative to failure tendency so that forgings are given a higher rating factor than the other product forms.

Heat Treatment - The effects of size at the time of heat treatment was considered the same for all materials. The susceptibility to SCC increases as the section size at the time of heat treatment increases.

Grain Direction - Grain direction is one of the most important variables affecting SCC. In the susceptible alloy temper combinations studied in this program, it is a major contributor to problems. Because of this it is weighted under this category where short transverse loading is suspected and also is part of the alloy and temper rating, i.e, 7075 and 7178 at a factor of 25.

The significance of this variable is best illustrated by a material comparison of the susceptible tempers at three stress levels taken from Alcoa's Technical Paper No. 17 (Reference 1), Figure 1.

Other - Other pertinent factors, included in the M&P rating were items most affecting SCC such as: (a) press-fit-bushings; (b) 50% stock removal; (c) thin-to-thick sections; and (d) cut threads. These items essentially define themselves as SCC problem contributors. The potentially high stresses associated with press-fit bushings, the end grain exposure caused by extensive machining, the high stresses likely when thick and thin parts are mated and the high K_T of threads all have been factors contributing to SCC.

Protection - Protective factors were also developed which followed as the second step in the M&P evaluation. These are treatments or finishes which assist in the prevention of stress corrosion cracking.

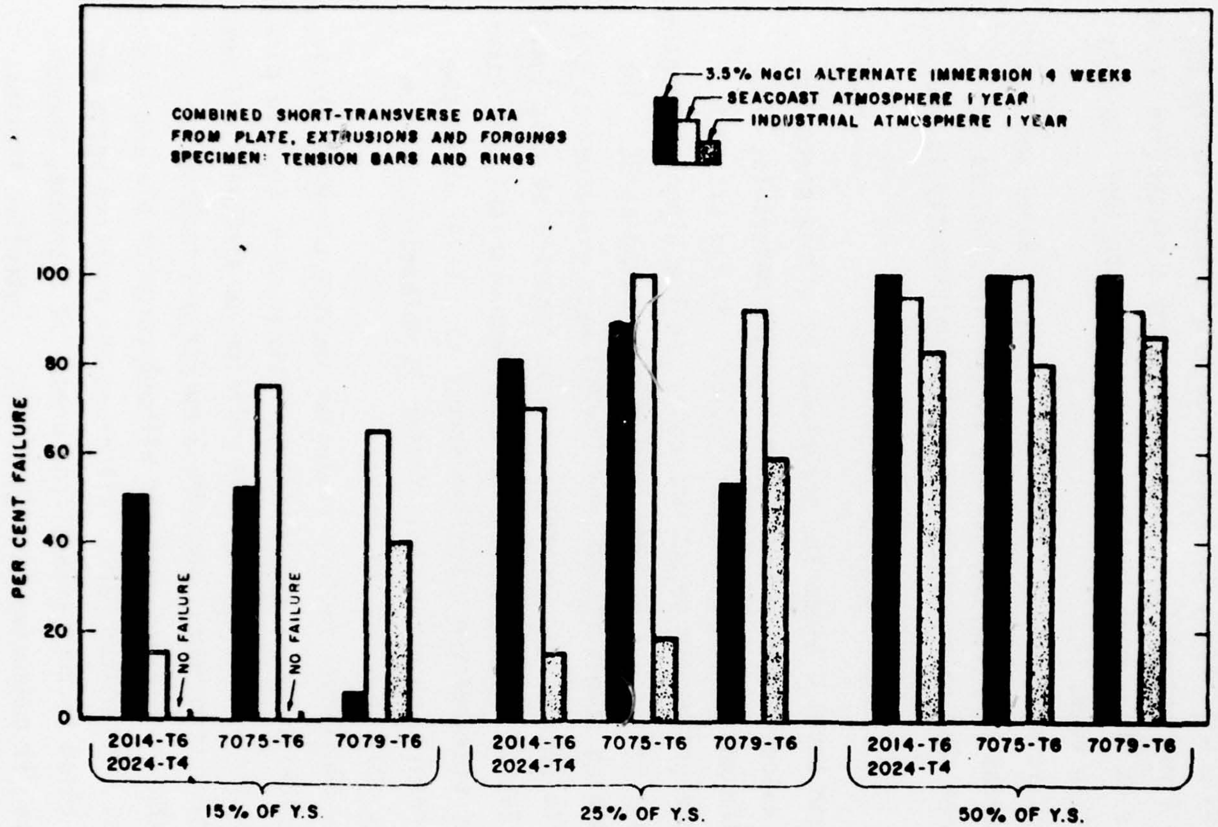


FIGURE I

COMPARISON OF THE PROBABILITY OF FAILURE OF SHORT-TRANSVERSE SPECIMENS IN SEVERAL ENVIRONMENTS

Because of the similar performance of short-transverse specimens from plate, extrusions and forgings, when exposed to the alternate immersion test, the data were combined for this comparison of environments (20 to 30 test specimens as basis for each bar graph).

Treatments considered are shot peening, sulphuric acid anodize, chromic acid anodize, chemical film, number of coats of primer, and finish top-coats. Rating numbers were applied to these treatments as shown in Table I.

As previously discussed, the parts receiving a total rating of 50 or more in the first materials evaluation then get a protective factor evaluation. Parts at 50 or more then are subjected to further study by the stress evaluation team.

The same basic approach was taken in evaluating steel parts with exceptions and changes more appropriate for steel. The factors considered are the ones that have contributed most significantly to SCC failures.

Steel

Strength Level - Since the occurrence of stress corrosion cracking has been associated with the higher strength materials, this has been used as the most heavily weighted factor. As the strength level increases, the propensity to SCC increases, so the higher strengths are given the higher ratings, i.e, 4340 (260 KSI) is rated at 35. The precipitation hardening steels (15-5PH and 17-4PH) were evaluated at the H-900 or 190 KSI Ftu level since SCC failures have occurred at this level.

Notch Factor - Failure experience has demonstrated that stress concentrations have elevated the effective stress to a level above the threshold. For screening purposes, this factor is related to minimum radii designated as .01, .03, and .06 inch.

Other - Additional factors evaluated include chromium plating, thick to thin transitions, press fit bushings, threads, and tapered pins. Chromium plating is included because of its relation to aircraft failures. Vought simulation of environmental and stress conditions considered present in a part that had failed with and without chromium plating demonstrated this effect. The plated parts failed and the unplated parts met requirements. The thick to thin transition, press fit bushings, threads, and tapered pins are all conducive to high stress. Protective finishes were not considered, since the benefits are easily lost in local areas due to part on part rubbing, scratches, disassembly, and other mechanical damage.

STRESS RATING

After the completion of the initial rating of a part or assembly for stress corrosion propensity based on material characteristics such as heat treatment, surface condition and finish, grain direction, etc., each item was reviewed to determine its susceptibility based on stress considerations such as assembly and function parameters. As in the case of the material rating, conditions and tolerances are considered and penalty points based on the degree of stress corrosion probability assigned to each part or assembly. The assembly and function factors chosen are: (The points are shown in Table III.)

- o Press fit bushings
- o Interference fit fasteners
- o Threads
- o Pressure
- o Sustained loading due to weight
- o Assembly tolerances/mismatch
- o Mating surface angularity mismatch

It can be noted that several of the factors chosen for structural rating are identical to those used in the material ratings. However, this is by design rather than inadvertant duplication. Where a part or assembly is downgraded for both materials and structural reasons, it is obvious that its susceptibility to stress corrosion is considered to be very pronounced and the double jeopardy assigned to such a part or assembly ensures that such tendencies are brought to light and investigated.

Because of the nature of stress corrosion, the structural factors selected for rating consideration are those which produce sustained or constant stresses in the structure into which they are installed. Structural elements which are threaded to accept bolts or screws are exposed not only to the constant loading due to the fastener torque requirements, but also to the very high stress concentration factors associated with threads. Pressure in components such as hydraulic cylinders, struts and fuel systems also maintain a steady state of loading even if just for the periods when the aircraft is operating. Several components are subjected to sustained stresses while the aircraft is not operating. This group includes landing gear components and any component whose function

is to support a mass such as black boxes, actuators and structural elements. Because of the mass production process used in fabricating todays aircraft, mating parts quite often do not fit precisely due to tolerance build-ups and some degree of "pull down" is permissible during assembly. Likewise, angular tolerances allow for the same type of "pull down." When this happens a permanent induced stress is introduced into the component which greatly enhances its chances of stress corrosion attack. These stress rating factors are applied to each component or assembly in values ranging from 0 to 20, depending on the severity of the particular condition. In some instances the evaluation is a 'yes' or 'no' situation where the amount of devaluation is set as in the case of threads in a structural component.

The fact that modern mass production techniques allow for parts and assemblies to be joined when mating surfaces do not exactly fit creates a very real and troublesome aspect of stress corrosion control. Because of these manufacturing and assembly tolerances, parts are often joined and mechanically fastened in a manner which allows "pull down" or "clamp up" of one part to another. The "pull down" or "clamp up" type of constant induced stress has been separated into two categories for this study as follows:

Assembly mismatch - where two surfaces are essentially parallel but separated by some finite difference (Figure 2).

Angular mismatch - where two mating surfaces meet in the correct plane, but an angular tolerance on one part causes a "pull down" situation to exist (Figure 3).

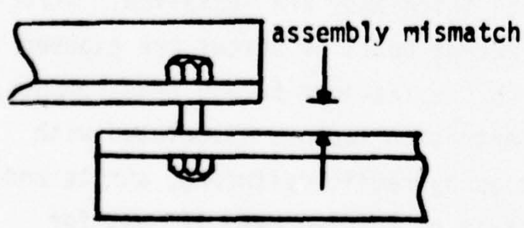


FIGURE 2

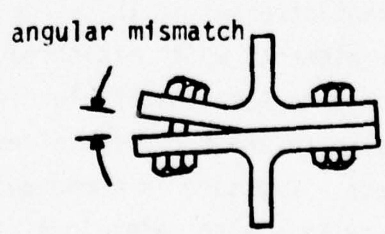


FIGURE 3

As can be seen, the possibility exists where both of these mismatch situations could be encountered during the joining of two parts. For this reason, each category is treated separately to insure that the total detrimental effect of such an assembly is considered and accumulated.

In the case of assembly mismatch, the stress induced is primarily a direct function of the relative stiffnesses of the two parts and the amount of "gap" which must be closed by the fastener. This problem is found mainly in the splice joints between production breaks in the heavy longeron members. A permissible mismatch is allowed, usually .01" to .05". If the mismatch exceeds this amount, it is detected by inspectors during the assembly process and either corrected or shimmed so that the pull-up does not exceed the allowable mismatch. When parts are rated for SCC susceptibility using this criteria, the degradation points assigned for each of the parts are based on the induced stress. No degradation points are assigned if the induced stress does not equal or exceed the SCC threshold stress for the particular materials(s). As the threshold stress is exceeded, degradation points are assigned as a function of the stress exceedance.

Angularity mismatch stresses are quite similar to those of assembly mismatch, but are more complicated in nature due to the many variables possible in a joint. In the case of extrusions as many as six separate stiffnesses must be considered to arrive at the final stress induced in an assembly. Because of this complexity associated with extrusions, an additional screening was applied to them. Development of this system is shown below. Figure 4 shows the various considerations which must be included.

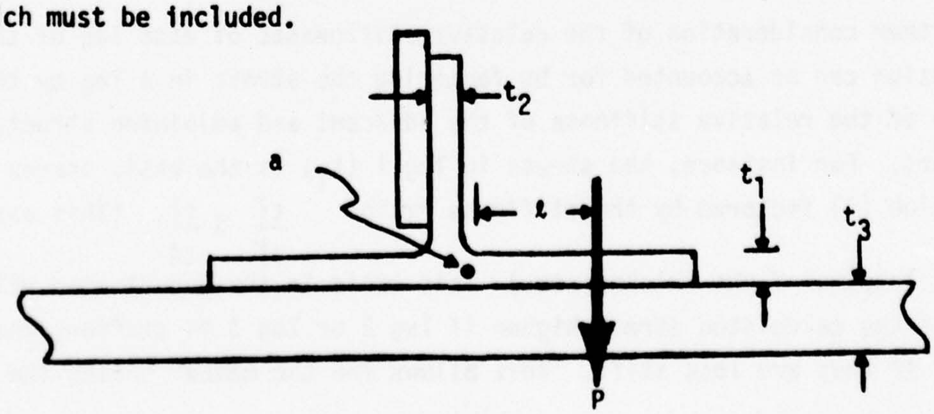


FIGURE 4

To determine the stress induced in a particular element of the extrusion shown above, a system was developed which considered the several stiffnesses involved. The primary assumption made was that the stress in any of the extrusion legs was

$$\sigma = \frac{Mc}{I} \quad \text{and } M = P\ell$$

where P is the force required to "pull down" the leg through a distance of .006 inch at the fastener. (The .006 dimension represents the maximum gap which will not be shimmed at installation.) Also

$$\partial = \frac{P\ell^3}{3EI} \quad \text{or} \quad P = \frac{3EI\partial}{\ell^3} \qquad (1)$$

for a cantilever beam fixed at one end.

$$\text{If } M = P\ell, \text{ then } M = \frac{3EI\partial}{\ell^3} \cdot \ell \text{ or } M = \frac{3EI\partial}{\ell^2} \qquad (2)$$

Using equation (2), the cantilever stress at the "fixed" end of the leg (point a) is

$$= \frac{Mc}{I} = \frac{3EI\partial c}{\ell^2 I} \qquad \text{but}$$

$$c = \frac{t}{2} \text{ so} \quad = \frac{3E\partial t}{2\ell^2} = \frac{3E\partial t}{2\ \ell^2} \qquad (3)$$

A further consideration of the relative stiffnesses of each leg of the extrusion can be accounted for by factoring the stress in a leg by the ratio of the relative stiffness of the adjacent and adjoining structural members. For instance, the stress in leg 1 (t_1) is the basic stress of equation (3) factored by the stiffness ratios $\frac{t_1^3}{t_2^3}$ & $\frac{t_1^3}{t_3^3}$. (This assumes equal lengths of the thicknesses.) This ratio in the denominator will adjust the calculated stress higher if leg 2 or leg 3 is stiffer, and lower if they are less stiff. This allows for the member seeing the

majority of the deflection, thus the majority of the bending stress, to have a higher calculated stress.

An additional consideration takes into account that if the thicknesses of all the mating elements are equal, the cantilever stress of equation (3) is too severe due to the end fixity not really being absolutely rigid. For this reason a factor of 0.50 was considered to produce a reasonable stress value and was applied to the equation (3) stress. A final adjustment on the calculated stress is that of a stress concentration factor to account for the stress raiser at the corner radius of the element. This factor has been set at 1.25 for this program based on Vought and industry wide data. The final equation for the stress in a part having a thickness t_1 due to angular mismatch becomes

$$= \frac{3EI\partial t}{2\ell^2} \qquad \frac{(1.25)(.50)}{\frac{t_1^3}{t_2^3} \quad \frac{t_1^3}{t_3^3}}$$

Using this expression for induced stress, a short computer routine was written which calculated a stress value based on varying thickness and length combinations and compared these stresses with a given stress corrosion threshold stress. If the calculated stress was below the specified threshold stress, "OK" was noted for the particular thickness and length combination. If the threshold stress was exceeded, a blank space showed that there was a possible problem and that a more detailed examination of the part was warranted.

This computer routine was developed as a tool for the initial screening of extruded parts, extrusions, because of the vast number which required examination. As a screening tool, it was not intended to cover all applications, but mainly outstanding/protruding legs of T, J. H, and C sections. It could, however, be useful in many other applications if the proper precuations were taken and the limitations recognized. Typical pages out of this computer routine are shown in Figures 5 and 6.

THRESHOLD STRESS = 37000 PSI

T1	T2	T3	L=.5	L=.6	L=.7	L=.8
			********* STRESS AT L			**********
.040	.040	.040	OK	OK	OK	OK
.040	.040	.060	OK	OK	OK	OK
.040	.040	.080				OK
.040	.040	.100				
.040	.040	.200				
.040	.040	.300				
.040	.040	.400				
.040	.040	.500				
.040	.060	.040	OK	OK	OK	OK
.040	.060	.060				
.040	.060	.080				
.040	.060	.100				
.040	.060	.200				
.040	.060	.300				
.040	.060	.400				
.040	.060	.500				
.040	.080	.040				OK
.040	.080	.060				
.040	.080	.080				
.040	.080	.100				
.040	.080	.200				
.040	.080	.300				
.040	.080	.400				
.040	.080	.500				
.040	.100	.040				
.040	.100	.060				
.040	.100	.080				
.040	.100	.100				
.040	.100	.200				
.040	.100	.300				
.040	.100	.400				
.040	.100	.500				
.040	.150	.040				
.040	.150	.060				
.040	.150	.080				
.040	.150	.100				
.040	.150	.200				
.040	.150	.300				
.040	.150	.400				
.040	.150	.500				
.040	.200	.040				
.040	.200	.060				
.040	.200	.080				
.040	.200	.100				
.040	.200	.200				
.040	.200	.300				
.040	.200	.400				
.040	.200	.500				
.040	.250	.040				
.040	.250	.060				
.040	.250	.080				

FIGURE 5 2024-T3X, T4X EXTRUSION SCREENING

THRESHOLD STRESS = 37000 PSI

T1	T2	T3	********* STRESS AT L *********			
			L=.5	L=.6	L=.7	L=.8
.200	.060	.040	OK	OK	OK	OK
.200	.060	.060	OK	OK	OK	OK
.200	.060	.080	OK	OK	OK	OK
.200	.060	.100	OK	OK	OK	OK
.200	.060	.200	OK	OK	OK	OK
.200	.060	.300	OK	OK	OK	OK
.200	.060	.400	OK	OK	OK	OK
.200	.060	.500	OK	OK	OK	OK
.200	.080	.040	OK	OK	OK	OK
.200	.080	.060	OK	OK	OK	OK
.200	.080	.080	OK	OK	OK	OK
.200	.080	.100	OK	OK	OK	OK
.200	.080	.200	OK	OK	OK	OK
.200	.080	.300	OK	OK	OK	OK
.200	.080	.400	OK	OK	OK	OK
.200	.080	.500		OK	OK	OK
.200	.100	.040	OK	OK	OK	OK
.200	.100	.060	OK	OK	OK	OK
.200	.100	.080	OK	OK	OK	OK
.200	.100	.100	OK	OK	OK	OK
.200	.100	.200	OK	OK	OK	OK
.200	.100	.300	OK	OK	OK	OK
.200	.100	.400		OK	OK	OK
.200	.100	.500				OK
.200	.150	.040	OK	OK	OK	OK
.200	.150	.060	OK	OK	OK	OK
.200	.150	.080	OK	OK	OK	OK
.200	.150	.100	OK	OK	OK	OK
.200	.150	.200	OK	OK	OK	OK
.200	.150	.300			OK	OK
.200	.150	.400				
.200	.150	.500				
.200	.200	.040	OK	OK	OK	OK
.200	.200	.060	OK	OK	OK	OK
.200	.200	.080	OK	OK	OK	OK
.200	.200	.100	OK	OK	OK	OK
.200	.200	.200		OK	OK	OK
.200	.200	.300				
.200	.200	.400				
.200	.200	.500				
.200	.250	.040	OK	OK	OK	OK
.200	.250	.060	OK	OK	OK	OK
.200	.250	.080	OK	OK	OK	OK
.200	.250	.100	OK	OK	OK	OK
.200	.250	.200				OK
.200	.250	.300				
.200	.250	.400				
.200	.250	.500				
.200	.300	.040	OK	OK	OK	OK
.200	.300	.060	OK	OK	OK	OK
.200	.300	.080	OK	OK	OK	OK

FIGURE 8. 2024-T3X, T4X EXTRUSION SCREENING

TABLE I

ALLOY & TEMPER	RATING FACTOR
7075-T73	0 points
7049-T73, 7050-T736	1
2024-T6, 2024-T8	5
2014-T6, 2024-T3, 2024-T4	10
7075-T6	20
7079-T6, 7178-T6	25
INITIAL THICKNESS	
° Bar & Extrusions	
Up to 0.75 inches	4
0.76 to 2.00	8
2.01 and Up	10
° Plate	
0.25 to 1.50 inches	4
1.51 to 2.00	8
2.01 and Up	10
° Forgings	
0.75 to 2.00 inches	8
2.01 and Up	10
HEAT TREAT THICKNESS (MAX)	
Up to 1.00	3
1.01 to 2.00	5
2.01 to 3.00	8
3.01 and Up	10
OTHER PERTINENT FACTORS	
Short Transverse Load	20
Press-Fit-Bushings	15
50% Stock Removal	15
Thin-To-Thick Sections	15
Threads	5

TABLE I

(CONTINUED)

PROTECTIVE TREATMENTS	RATING FACTOR
Shot peen before plate	-10 points
Sulphuric acid anodize	- 5
Chromic acid anodize	- 3
Chemical film	- 2
One coat primer	- 3
Two coats primer	- 5
Topcoat	- 5

TABLE II

Alloy-Heat Treat Level	Rating Factor
Low Alloy Steel and Maraging Steel	
200,000 - 220,000 psi	25
260,000 & up	35
Precipitation Hardening Steels 17-4PH & 17-7PH	
Cond. H-900 (approx. 190,000 psi)	25
Notch Factor	
.01 radius	20
.03 radius	15
.06 radius	10
Other Pertinent Factors	
Chrome plate	5
Thick to thin sections	10
Press fit bushings	10
Threads	5
Tapered Pins	10

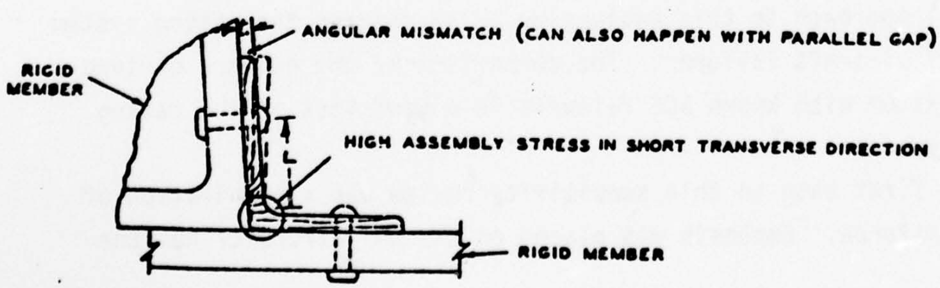
TABLE III

SUSTAINED LOADING RATING FACTORS

Multiple press fit busings		5 pts
Interference fit fasteners		10 pts
Torque loading		10 pts
Pressure loading		10 pts
Sustained loading due to weight		10 pts
Sustained loading due to assy	(See Table IV)	0 - 20 pts
Allowed angularity		
0.5°		0 pts
1.0°		5 pts
2.0°		10 pts

SUSTAINED LOADING DUE TO ASSY. RATING
TABLE IV (FOR SHORT TRANVERSE ALUMINUM LOADING)

t	L							
	.1	.25	.5	1.0	1.5	2.0	2.5	3.0
.060	20	17	4	0	0	0	0	0
.090	20	20	10	0	0	0	0	0
.120	20	20	17	4	0	0	0	0
.175	20	20	20	5	0	0	0	0
.250	20	20	20	15	8	5	3	3
.375	20	20	20	20	16	11	7	5



2.1 CRITICALITY RATING

The criticality rating was established based on often used categories, which have been valuable in assessing aircraft structure. This criteria correlates with SD-24K requirements in paragraph 6.5.5.1 defining "Critical Parts." The heavy weighting is placed on parts that are most vital. This rating allows consideration at operational levels as to the urgency in evaluation of SCC prone parts.

CRITICALITY	CRITICALITY CRITERIA
1	Non-vital structure. Failure would not constitute a safety hazard or result in marginal load carrying capability.
3	Failure could result in minor damage, or could require aborting a flight. Example: Landing gear uplock system parts.
5	Failure could result in reduction of fail-safe capability, degrade the aircraft handling characteristics or result in marginal load carrying capability.
9	Failure could result in major damage to the aircraft controlability.
10	Failure could result in loss of the aircraft or a major component or in serious injury to the occupants.

2.2 FAILURE HISTORY AND SENSITIVITY STUDY

An important part of the procedure used in establishing and developing a viable rating system is evaluation of the rating system. The logical approach to this evaluation is to compare the rating system with actual aircraft failures. The comparison of the numbers derived from the system with known SCC failures is a good test of the rating sensitivity.

The first step in this sensitivity review was a compilation of aircraft failures. Emphasis was placed on the A-7 aircraft/ but the

F-8 and S-3A aircraft data was utilized to maximize the background information needed to identify parts susceptible to SCC. Failures in the F-8 were considered as potential problems in the A-7 because of aircraft similarities, and the S-3A data was mainly reviewed in order to correlate findings with similar A-7 parts. The part number, name material/temper, product form, and description of A-7 SCC failures is shown in Table V. This list does not address every failure, but includes parts on which a failure analysis was conducted and those reported in Navy reports as SCC failures.

Several parts from this list were evaluated using the rating system with positive results. All of these parts were designated suspect, so the system was considered workable. Failures that appeared after this rating system was applied also graded out as suspect. These include the 490 Bulkhead (215-30079) and the UHT Shaft (CV15-160033).

The following list (Table VI) of trial parts was subjected to the initial sensitivity study. A further sensitivity review was made after the extrusion evaluation was initiated. The system used for other product forms did not appear to differentiate enough between the extruded shapes. At this point the "pull down" computer runs relating the SCC threshold to a maximum "pull down" and mating part thickness was applied to the extrusions. Where the analysis showed a potential problem, the drawings were reviewed for assembly stress. Because this system applies to protruding legs of T, J. H, and C sections, other extrusion trouble variables were examined. Extrusions with the following characteristics were further evaluated:

1. Heavy sections (over 1 inch)
2. Straightening requirements
3. Hinge type parts

TABLE V. A-7 STRESS CORROSION CRACKING FAILURES

Part Number	Part Name	Material Temper	Product Form	Description or Location
215-70409	Wing Fold Rib	7075-T6	Forging	Lug I.D.
215-70422	Pylon Support	7075-T6	Forging	I.D. radius
215-24031	NLG Shock Strut Cylinder Housing	7075-T6	Forging	I.D. of bushing hole
33 22704	Breaker Assembly	7075-T6	Forging	I.D. of hole
CV15-908647	Funk Spring Barrel	2024-T3	Bar	I.D. threads
215-70058	Pylon Attach Lug	7075-T6	Forging	--
215-24032	NLG Shock Strut Inner Cylinder	7075-T6	Forging	O.D. threads
215-30411	Wing Truss Bar Lug	7075-T6	Forging	Hole end grain
215-80200	Flap Hinge	7075-T6	Extrusion	I.D. of radius
215-70055	Fin Pull Cyl. WFR	7075-T6	Forging	Outside of lug
215-24065	NLG Collar	4340/200 Ksi	Bar	O.D. corner of lug
215-70194 (CVC 10041-36)	Flap Slot Door Hinge	7075-T6	Extrusion	Lugs, pressed fit bushing
215-30073	480 Bulkhead	7075-T6	Forging	I.D. of lug
215-30420	Catapult Long. Splice	7075-T6	Extrusion	In line with attachment holes
218-30081	Catapult Long.	7075-T6	Extrusion	In line with attachment holes
CV15-160033 -160516 (forging)	Shaft Inst. UHT	4340/260Ksi	Forging	Skin attach hole areas
215-30079	490 Bulkhead	7075-T6	Forging	Between lower lugs
215-70418	Wing Spar	7075-T6	Plate	Flange-Web radius
215-70425	Pylon Support	7075-T6	Forging	I.D. Radius

TABLE VI

TRIAL PARTS, SENSITIVITY STUDY

Part Number	Alloy	Product Form
215-80200	7075	Extrusion
215-24030	7075	Forging
CV15-908647	2024	Bar
CV29-910502	7079	Extrusion (F8)
215-30078	7075	Forging
21-658520	2014	Forging
215-30411	7075	Forging
215-24031	7075	Forging
215-70422	7075	Forging
215-70425	7075	Forging
215-70058	7075	Forging
MS21912 D16	2014	Forging
215-30420	7075	Extrusion
21-480501	7079	Plate (F8)
215-70409	7075	Forging
215-24065	4340	Forging
215-30081	7075	Extrusion

3.0 RESULTS AND DISCUSSION

3.1 RATING LIST

The three lists developed are the, (1) Numeric, (2) Criticality, and (3) the Stress Corrosion-Failure Probability, Figure Numbers 17, 18, 19.

The Numeric list contains complete information including the material product form, next assembly, rating factors, the SCC rating, the Criticality rating, the failure occurrence, inspection, and improvement data. The rating factors, SCC rating, and the rationale used have been discussed in Section 2.0. The Criticality definition is explained in Section 2.1.

The location of the part is defined by using TA-7C Illustrated Parts Breakdown (IPB) Technical Manual and Structure Repair Manual (SRM) with Volume, Figure, and Index shown as available. Location of the part and next assembly is then feasible. This gives an overview or summary of the program in table form.

The Criticality list eliminates some of the details such as the rating factors, and lists the criticality of the susceptible part from most critical to least critical. These are broken down into groupings by volume number using the TA-7C Illustrated Parts Breakdown (IPB) Technical Manual and Structure Repair Manual (SRM). This makes it feasible to easily locate and check the most critical of the susceptible parts. The inspection and suggested improvement are also easily found.

The SCC-Failure Probability list highlights the SCC rating in listing them from most susceptible down through least susceptible. The same grouping by IPB and SRM Manual Volume number is used to make location as expeditious as practicable.

Stress Corrosion Cracking (SCC) failure occurrence is charted in the same manner as the Criticality List with parts being listed by SCC susceptibility. All the other data such as Criticality is shown for cross reference and correlation.

The inspection column on each list is divided into three categories: A - Accessibility; B - Difficulty; C - Method. These ratings are defined further as follows:

A - Accessibility

1. Failure prone area readily visible.
2. Component/assembly removal required.
3. Failure prone area visible by removal of inspection covers, fairings, access panels, etc.
4. Failure prone area covered by structure/skin.
6. Failure prone area accessible with difficulty or accessible upon removal of adjacent hardware or equipment.
10. Failure prone area buried, major disassembly required.

B - Difficulty - Where part may be inspected and location of Inspection

1.	Inspection in place	- simple
2.	Inspection in place	- difficult
3.	Inspection in place after removal of obstruction	- simple
4.	Inspection in place after removed sub-assembly	- difficult
5.	Inspection as part of removed sub-assembly	- simple
6.	Inspection as part of removed sub-assembly	- difficult
7.	Inspection after major disassembly	- simple
8.	Inspection after major disassembly	- simple

The "Location" is indicated under the "Difficulty/Where" rating number. Phase and/or Depot locations are called out to allow for flexibility. The choices between Phase and Depot were made on the following basis, but are left discretionary except where experience dictates otherwise.

Phase is used where it was considered that the organizational ("O") level has the capability to perform the inspection without sacrificing lengthy "down time." Generally every third phase interval would be considered.

Depot is used where it was considered that time consuming inspections can be most economically performed during depot level maintenance. These need not be performed as frequently as the phase interval.

C - Method

This column defines the best method for looking at the failure prone area. Some of these operations are already called out due to previous problems or suspected problems. Others are based on what appears to be the best or a viable approach to evaluating the prone area. The inspection legend used is:

1. Visual - direct, mirrors, etc.
2. Penetrant
3. Ultrasonic
4. Eddy Current
5. X-ray
6. Other

Improvement Method

The suggested improvement method is shown on the rating lists in a brief format to highlight the main features. Further discussion of these methods is in Section 3.2, Supportive Data. Some of the methods are only applicable when the aircraft section is disassembled. Others can be applied without any engineering changes.

Hard Landing Effects

Parts that may be affected by hard landings are noted in the Numerical Part List by an HL under the Pressure column.

3.2 SUPPORTIVE DATA

3.2.1 Improvement Methods

The improvement methods suggested are mainly ones that have been successful in solving similar type problems in the past. Newer approaches such as the aluminum coating (IVD) are also called out where a more simple solution is not available.

Some of the improvements listed are incorporated in aircraft; but because of effectivity or logistics problems or limitations may not be incorporated in all TA-7C aircraft. As an example, the catapult longeron and longeron splice, P/N 220-30081 and P/N 215-30420,respectively, have been changed to correct the high stress condition. Shim and fastener changes are incorporated in assembly drawing 218-30057.

Material/temper changes are not called out although use of the stress corrosion cracking resistant aluminum alloy/temper combinations such as 7075-T73, -T76, 7049-T73, 7050-T736, -T76 would eliminate the SCC potential. However, use of these would entail considerable engineering work and in most cases part size changes due to mechanical property differences. The SCC resistant material/temper combinations were used on all new parts designed for the TA-7C aircraft.

Some improvement methods are results of recent Vought efforts related to failures. One fitting in this category is the improvement outlined for the UHT Shaft, P/N CV15-160033. The sustained stress level was increased due to corrosion product buildup between the steel shaft and the aluminum skin. Moisture at this faying surface could be minimized by applying sealant at this surface before installing the fasteners. This approach has been effective in other faying surface areas on this same assembly P/N 216-60200.

Suspect bushing installations in aluminum have a common solution for improvement. This encompasses the addition of a chamfer, so that sealant can get into the interface between the bushing and aluminum. This approach gives assurance that moisture is kept out of the joint. The rating list points out the need for stress analysis due to the material removal.

Vought has applied commercially pure aluminum to 7075-T6 aluminum by flame spray techniques to a one to three mil thickness. This was overcoated by a chromate containing primer and enamel. This system protected four of five specimens stressed in the short transverse direction for a year in the alternating immersion test. The fifth specimen failed after 50 weeks exposure. Alcoa who tested these specimens later showed 7072 flame sprayed on 7075 to also be highly protective against SCC. McDonnell-Douglas has pioneered the use of ion vapor deposited (IVD) aluminum onto steel parts as a corrosion protection. More recently they have shown, as did Vought, that the aluminum is protective against stress corrosion cracking. Since the IVD can be used to better control thickness in the .0003 to .0005 inch range, this would be a preferred technique for application to the flame spray technique. Proprietary equipment is involved and the parts must be placed in the IVD chamber for

aluminum deposition. Flame spray aluminum can be applied with equipment commonly available and in some cases could be applied selectively to parts. When the surface is accessible, it can be sprayed without complete disassembly.

Other miscellaneous improvements such as additional sealing, added paint coats, corrosion preventative, faying surface sealing and plating changes are called out where they are considered to be the most expedient method of improvement.

3.3 PROBLEM AREAS

Problem areas related to the rating system are mainly associated with a lack of information or data. A drawing review yields considerable information on the part from raw material through assembly, but is limited in that the actual manufacturing steps used to meet the drawing requirements are not known in detail. The questions as to how effective is the tooling, what operator mistakes negate the best tooling, and what errors may be missed by inspection all have a bearing on the accumulated stress the part is subjected to and on how well the protective systems function. Another problem in part analysis is that microfilm of drawing assemblies is difficult to evaluate due to the small size.

Knowledge of the shop practices and long term experience with the aircraft highlights what should be looked at so the ratings are very effective. The following discussion does illustrate that it is not 100 percent effective. As indicated in the rating system description, (paragraph 2.0) extrusions appear to be less sensitive than other product forms.

The extrusion history shows only four failures. A breakdown of these shows that two of the part failures are related to the same assembly problem, and only one other has been repetitive. Out of thousands of parts made from extrusions, this is a small number of occurrences.

An in depth study was made of these failures by reviewing laboratory data and discussing the failures with cognizant design specialists. The objective was improvement in the extrusion rating system.

The extrusion failures attributed wholly or partially to SCC are:

	Part Number	Extrusion Number	Failure Location
1.	215-70194	CVC10041-36 or CVC10041-38	Lugs, pressed fit bushing
2.	215-80200	CVC10041-21	I.D. or radius
3.	215-30420	CVC10020-29 or CVC10072-68	In line with attachment holes
4.	215-30081	CVC10060-11 (7 x 2.75)	In line with attachment holes

These failures fit three very distinct and different categories. Failures numbered 3 and 4 are associated with the same assembly problem. Failure number 1 was attributed to high stress in the lug bushing hole applied during rigging of the assembly. Failure number 1 was attributed to high stress in the lug bushing hole applied during rigging of the assembly. Failure number 2 as at the I.D. of a radius where straightening is indicated.

The failure listed as number 1 is in the Outboard Flap Slot Door. P/N 215-70194 (made from CVC10041-36 or -38 shown in Figure 7) failed by SCC in the lugs starting in the I.D. of the bore. This is a hinge where trouble was frequent and attributed to rigging. A small preload tolerance condition prevailed in that a high preload caused SCC and insufficient preload created gapping, which caused overload failures. Infrequent fatigue failures appeared to be associated with a stress condition following SCC failures in other lugs.

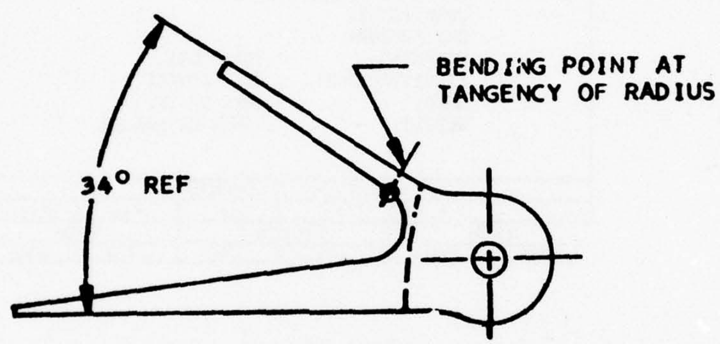
Examination of the rating system used for the other product forms would have left this part under 50 in rating. The additional "pull down" approach does not indicate a problem. Unfortunately a stress evaluation would only highlight the pressed fit bushing. The rigging related stresses are not visible to the drawing reviewer.

Because of the failure history, this part was changed to 7075-T73511 from 7075-T6511. Higher stresses were then acceptable with the higher SCC threshold of the T73511 temper. The overload and fatigue failures related to the problem also have not recurred.

The failure listed as number 2 is the Flap Assembly, Wing Landing L. E. Outboard P/N 215-80200 made from CVC10041-21 shown in Figure 8.

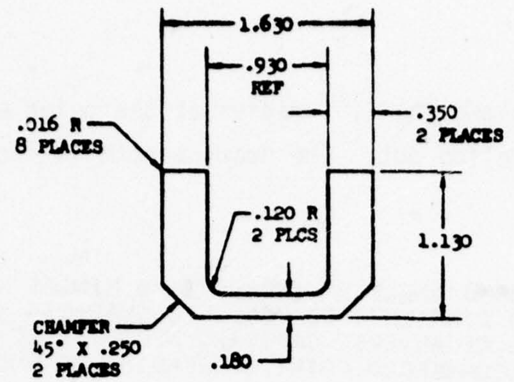
This part failed along the I.D. radius at the point where bending for straightening is called out. The drawing note is shown below.

11. THE ENCLOSED ANGLE OF THE -5 & -6 HINGES SHOULD BE CHECKED & STRAIGHTENED PER SPEC CVA2-134 TO MINIMIZE THE OCCURRENCE OF ADVERSE GAPS AND AERODYNAMIC CONDITIONS ON ASSY. RECOMMENDED POINT OF BENDING AS SHOWN.



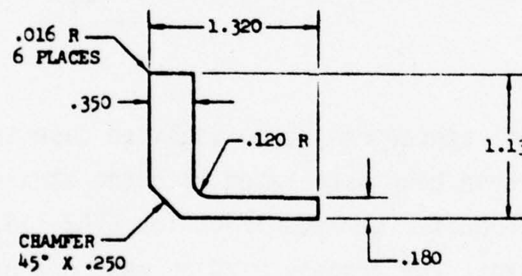
This failure appears to be an isolated case as only one has been reported. It may have been associated with the straightening operation. Straightening is conducted per Specification CVA2-134, which permits cold or hot straightening. The process used on most operations is not defined beyond specification limits. The stress study on this part determined that assembly buildup would not be expected at the failure point on the I.D. Assembly analysis indicates that this location would be in compression.

The failuires numbered 3 and 4 are the Catapult Longeron Splice P/N 215-30420 made from CVC10020-29 or CVC10002-68 shown in Figure 9, and the Catapult Longeron P/N 218-30081 made from CVC10060-11 (a 7" x 2.75" rectangular shape). These failures were associated with discrepancies in shimming and an inadequate attachment design. This situation has been corrected. A stress study of this part from the drawings concluded that the stress was low in this assembly.



PART NUMBER: CVC10020-29
REF PART NUMBER:
CODE IDENT:
DIE NUMBER:
MATERIAL: 7075-T6511
SPECIFICATION: QQ-2-200/11
AREA: .892 SQ IN.
WEIGHT: .0892 LB PER IN.

SECTION ELEMENTS					
$\bar{x}$	$\bar{y}$	I_{xx}	I_{yy}	ρ_{xx}	ρ_{yy}
INCH		INCHES⁴		INCH	
.815	.530	[illegible]	[illegible]	.370	.450



PART NUMBER: CVC10002-68
REF PART NUMBER:
CODE IDENT:
DIE NUMBER:
MATERIAL: 7075-T6511
AREA: .542 SQ IN.
WEIGHT: .0542 LB PER IN.

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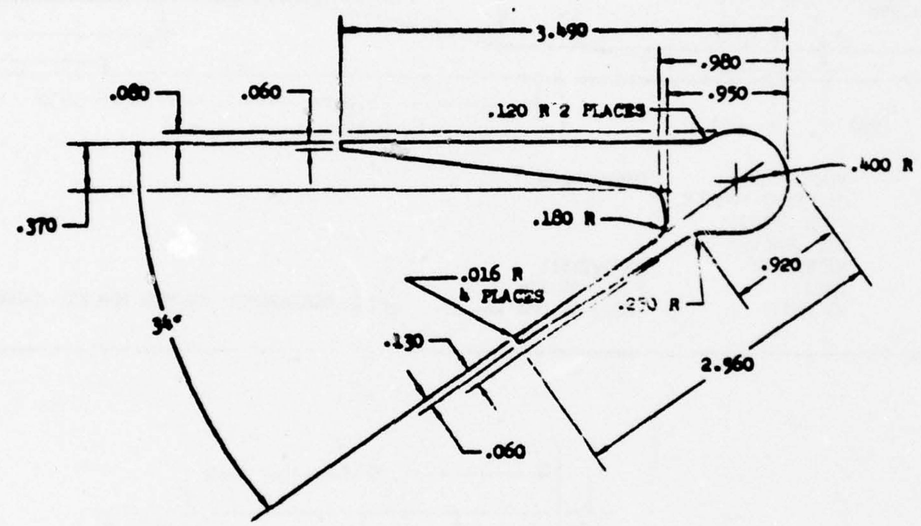
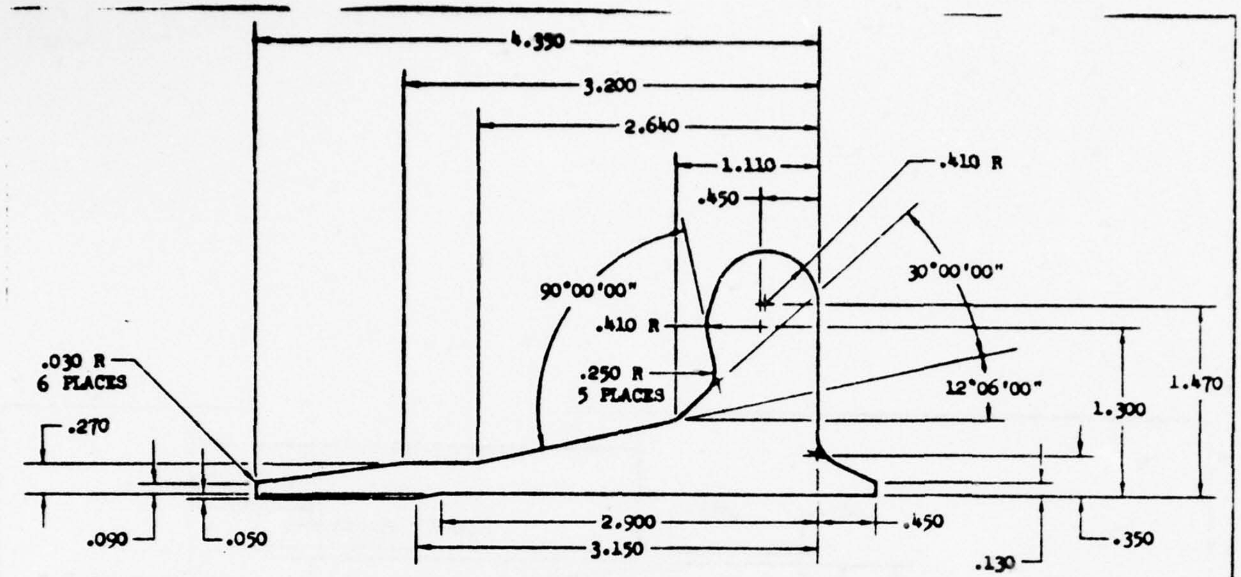
SECTION ELEMENTS					
$\bar{x}$	$\bar{y}$	I_{xx}	I_{yy}	ρ_{xx}	ρ_{yy}
INCH		INCHES⁴		INCH	
.350	[illegible]	[illegible]	[illegible]	.650	.830

FIGURE 7



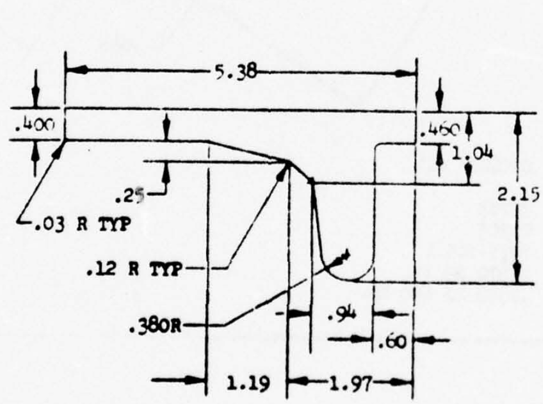
PART NUMBER:	CVC10041-31
REF PART NUMBER:	
CODE IDENT:	77783
DIE NUMBER:	41363
MATERIAL:	7075-T6511
AREA:	1.370 SQ IN.
WEIGHT:	.1370 LB PER IN.

FIGURE 8



PART NUMBER: CVC10041-38
REF PART NUMBER:
CODE IDENT:
DIE NUMBER:
MATERIAL: 7075-T6511
AREA: 2.870 SQ IN.
WEIGHT: .2870 LB PER IN.

Ⓑ ULTRASONIC INSPECT PER MIL-I-8950 CLASS B.



PART NUMBER: CVC10041-36
CODE IDENT: 02992
DIE NUMBER: T-10553
MATERIAL: 7075-T6511
AREA: 3.86 SQ. IN.
WEIGHT: .386 LB PER IN.

Ⓑ ULTRASONIC INSPECT PER MIL-I-8950 CLASS B.

FIGURE 9

In spite of these isolated cases the rating system is expected to highlight potential problem parts.

A problem area not associated with specific parts, but of some significance is that related to the effect of hard landings. Some relationship has been postulated between hard landings and failures where other data seemed to indicate that a stress high enough for failure did not exist. An example of this would be the UHT shaft P/N CV15-160033. Further study indicated that stress induced by factors such as corrosion product buildup in a faying surface and machining steps could contribute stress sufficient to exceed the SCC threshold of the 4340 steel shaft. Since a quantitative value is difficult to assign to hard landing effects, the numeric parts list carry an alert in the form of an HL (hard landing) for parts where hard landing may cause concern.

Another point in the rating system subject to question is the value of chemical films. After the program ratings were utilized, new data has shown that chemical films are of no value as far as SCC is concerned. Since the minus 2 point rating advantage assigned to chemical films is small, the parts were not re-evaluated.

3.4 CADMIUM EMBRITTLEMENT OF TITANIUM

A cursory review of the literature indicates that the problem of cadmium embrittlement of titanium has been confined predominantly to cadmium plated fasteners. The requisites for this phenomenon appear to be a combination of "intimate' contact with cadmium and a sustained tensile stress in the titanium. Although cracking can occur at room temperature, it is generally more severe at elevated temperatures in the order of 300 - 500^{o}F. Cadmium embrittlement failures have so far been mainly a laboratory curiosity; however, back in the early '70s Grumman pulled a number of cadmium plated fasteners out of aircraft structure (ambient environment) and found 4 out of 31 to have tight, intergranular cracks in the head to shank fillet area about 0.005" deep (reference 2).

In most of the cases cited in the literature, the titanium specimens were cadmium plated thereby insuring relatively good contact between the two metals. Subsequent loading and pressurizing of the specimens would invariably cause failure. However, some very limited testing at Vought did not produce failures of unplated titanium tensile specimens

pressurized with cadmium plated pressure plates; these specimens were loaded to 100 KSI and pressurized to 60 inch-pounds of torque at 200°F (reference 3). Here it was speculated that the titanium oxide on the specimens prevented the intimate contact required for embrittlement even at 60 inch-pounds of torque. On the other hand, SPS produced failures in bare titanium bolts assembled in cadmium plated cylinders, although in this case it is unknown what part abrasion or surface deformation during assembly played in the embrittlement mechanism (reference 4).

Therefore, although cadmium plating of titanium specimens undisputedly results in cracking embrittlement under the right conditions of pressure and sustained tensile stress, the case is not so clear cut for unplated titanium in contact with cadmium plated parts. In this case there may be another parameter involving the breakdown of the titanium oxide surface layer required before embrittlement can take place and this in fact may be part of the reason that titanium structural parts in contact with cadmium have been successfully used in aircraft structures for years. It is felt that further evaluation is needed before the reliability of unplated titanium parts in contact with cadmium can be evaluated, for example, the TA-7C parts listed in Table VII.

A further examination of this list shows that three parts (items 5, 7, and 8) have a high probability of meeting the requirements cited for solid cadmium embrittlement. These requirements (reference 5) are: (1) intimate contact between the cadmium and titanium, and (2) a tensile stress parallel to the surfaces exposed to the cadmium. Although reference 5 illustrated failures down to 100°F, the propensity to failure increases markedly with elevated temperatures making items 5, 7, and 8 the most likely failure candidates. However, it appears that the postulation concerning oxide layer effect is the reason even the parts exposed to temperatures above ambient have not failed.

4.0 STRESS ANALYSIS

4.1 MEASURED STRESS ANALYSIS

The Rigaku Strainflex Residual Stress Analyzer was used to determine residual stress in some TA-7C parts which have either shown indications of stress corrosion cracking in service or which, as designed, indicate a potential problem of this nature. Choice of the particular part to be analyzed was not always easy because of the limitations of the Strainflex equipment. That is to say, the geometry of the part was not easily adaptable to the Strainflex unless it was well exposed in order to get the x-ray head in position and allow the goniometer to sweep through approximately 10^{o}. For this reason, a specific spot on an assembled part would not always yield itself for analysis. It was possible, however, to analyze two aluminum parts and three steel parts. The unit is shown in Figure 10.

Parts Selection

Nine aluminum and nine steel parts were chosen for consideration for analysis. Of the aluminum parts, the 218-30507 keel fitting (Figure 12) and the 215-30402 bulkhead fitting (FIgures 13, 14) were selected as being representative. Of the steel parts, the CV15-160516 UHT horn, the 215-60210 UHT box and CV15-160033 UHT shaft were selected as being representative (Figure 15). The parts considered are shown in Figure 11.

Surface Preparation

All paint and anodize was removed from the surface of the part prior to electropolishing with a glacial acetic/perchloric acid solution in order to remove any disturbed aluminum from the outermost layer of material. The steel parts were stripped of paint and plating prior to wet sanding with #320 grit paper followed by a polish with #600 paper to obtain a flat surface. The steel parts are heat treated to RC 50-55 and were not electropolished because of potential hydrogen embrittlement from the acid solution.

Strainflex Measurements

The readings obtained are shown in Tables VIII and IX for aluminum and steel respectively. The keel fitting (218-30507) is produced from

heavy 7075-T6 aluminum plate. One part was obtained which had been final machined but had never been in an assembly. Readings were taken on various locations on the part to determine if residual stresses were present due to machining. A second part was obtained from an airplane returned to Vought for conversion to the TA-7C configuration. This part had exhibited cracking of the keel prior to disassembly. Readings were made in similar locations as on the new part for comparison.

The 215-30402 bulkhead (490 bulkhead) carries the main landing gear. Some cracking has been experienced in service on this part in the area between the lugs which pick up the major load. Readings were made on three separate parts but which were in various stages of fabrication, i.e, raw forging, after finish machining, and installed in the airplane. In each part, readings were made in similar locations in order to determine at what stage the part might be receiving treatment that would cause residual tensile stress.

The Strainflex was calibrated against a standard aluminum beam prior to the test series. A chromium target x-ray tube was used at 30 KV and 8 mA. The goniometer was swept from 162^{o} to 152^{o} in order to obtain the 2θ peak of 156.9^{o}. It should be noted that the instrument has a low limit of 140^{o} which precludes a much stronger peak at 139.5^{o}. Four readings were made for each location, at ψ angles of 0^{o}, 15^{o}, 30^{o}, and 45^{o}. The maximum peak position for each of these ψ angles was determined by the peak width at half height method and recorded as 2θ. The $\sin^2$ value for each ψ angle was determined from tables. The slope of a line formed by the 2θ value as the ordinate and the $\sin^2$ value as the abscissa was determined by the method of least squares. This value was then multiplied by a constant (K = -42.99 for iron and -13.5 for aluminum) to determine the amount of residual stress in pounds per square inch. If the slope of the line is positive, the residual stress will be compression, if negative, the residual stress will be tension.

DISCUSSION OF RESULTS

The aluminum keel parts (218-30507) had residual stresses in compression on all surface treated. This indicates that the cracking found in these parts after service is partially due to stresses produced by assembling two parts which did not fit properly. The cracks were found

in an area of poor drainage which would make it more subject to corrosive attack. If stresses are present, this corrosion would be followed by cracking. Because this area is inaccessible in the assembly, the stresses induced by assembling cannot be determined.

In the 490 bulkhead (215-30402) there are several locations where residual tensile stresses are present, even in the unmachined forging. The significance of these residual stresses is not known, however, the lack of uniformity and the fact that the part has cracked in service seem to be important. Because the areas where the residual tensile stresses were located on the aft side of the machined part, it was not possible to determine if any addition in the stresses was made during assembly in the airplane. One area was measured on the forward side opposite one of the bosses on the aft side which contained the tensile stress and was found to have a much higher compressive stress after assembly.

Reading number 8 on the forward side as machined was -24,300, and as assembled -36,450. The reading on the aft side at number 11 opposite number 8 shows a +15,525 reading as machined. It is felt that the higher tensile stress can be expected as was seen on the compressive side after assembly. Although this is not at the failure shown by the circle on the aft side (Figure 14) it does indicate high stresses are present before the effect of air loads are added.

The steel parts used in this evaluation make up the UHT assembly to the airplane. The box and shaft are heat treated to 260 KSI, the horn to 200 KSI. The parts are all shot peened to obtain compressive stresses on the outside surfaces. The consistency of the readings taken on these parts indicates that this compressive layer was present on all three parts uniformly.

Additional determinations were made on two other UHT shafts which were available because of a failure investigation. Similar results were found in these two parts as in the first three, i.e., a compressive layer on all outside surfaces. Because the cracks were being initiated at holes in the flange attachments of the shaft, an attempt was made to determine stresses very near the periphery of the holes by using a more

narrow x-ray beam. This was partially successful; however, approximately 1-1/16" was as narrow as the beam could be made to give a consistent signal to the detector. In any case, all the residual stresses were compressive and slightly lower in intensity.

It is believed that further work is needed to develop the technique of surface preparation. This would involve the tedious etching of the steel surface until the compressive stress layer is removed and the residual stresses which are present beneath can be measured.

4.2 CORRELATION OF MEASURED AND CALCULATED STRESSES

The relationship between the stress corrosion cracking phencmenon and calculated or measured stress is complicated. The main problem is that the combined sustained tensile stresses come from two sources - the applied stress and residual stress. Generally the stress calculated is from the loads that the part is expected to experience. With intricate shapes and complicated assemblies, calculation of these stresses is not very accurate. Instances of SCC at Vought were considered to be unlikely because calculated stresses were well below the stress corrosion threshold for the material utilized. No residual stresses of any magnitude could be ascertained. In other instances several sources of unexpected residual stress from manufacturing errors added up to a level above the threshold.

The parts that were found amenable to measurement of residual stresses using the Rigaku Analyzer are shown in Section 4.1. The comparison between calculated and measured stresses are most interesting where extensive stress calculations have been performed such as the 490 Bulkhead (P/N 215-30402) and the UHT Shaft (P/N CV15-160033).

A most revealing study was made on the UHT Shaft from BuNo 159659. Radiographic inspection revealed two cracks in the flange between fastener holes. Disassembly confirmed two cracks. The findings of this investigation are summarized as follows:

DESCRIPTION OF FINDINGS

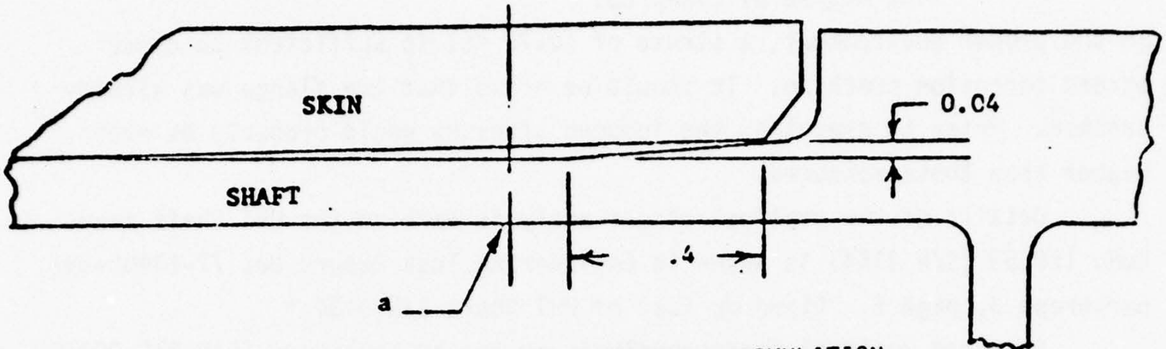


FIGURE 16. ASSEMBLY SIMULATION

1. The part was examined visually and was found to have an undercut on the surface of the flange containing the two cracks. A dimensional analysis was performed and it was determined that the thickness tapered approximately .04 inch from the forward edge aft to a point .4 inch from the fillet radius and then tapered back up to the tangent of the radius. The radius was also found to be out-of-tolerance.

2. A test was conducted to determine the level of clamp up stresses induced in the fitting as a result of the above conditions as follows:

   a. A simulated skin was attached to the fitting using standard fastener torque to determine the effect of "clamp-up" on surface stresses.
   b. Measurement of surface residual stresses, using a Rigaku Strain Flex Stress Analyzer (x-ray diffraction technique), was made in the area approximated by (a) in Figure 16 before and after installation of the simulated skin. Due to effects of shot peening high compression stresses are measured on the surface.
   c. A significant increase in compressive stresses was noted upon "clamp up" (60 to 70 KSI). A similar significant reduction of compressive stress probably occurred on the opposite surface of the flange. This change in surface

stress implies that tension stresses in the range of 60-70 KSI would be induced in the fittings beneath the thin layer affected by shot peening. Analysis predicts 60-100 KSI for the degree of clamp up.

In the proper environment, a stress of 60-70 KSI is sufficient to cause stress corrosion cracking. It should be noted that the flange was already cracked. Prior to cracking, the induced stresses would probably be even higher than those measured.

Details of the residual stress analysis made on the UHT Shaft from BuNo 159659 (S/N 3154) is shown in Engineering Test Report No. 77-53400-057, paragraph 3, page 5, "Clamp Up Test of UHT Shaft S/N 3154."

Measured residual stress analysis on the 490 bulkhead (P/N 215-30402) could not be effectively correlated with analyzed stresses in the failure location due to the Rigaku machine size. The failure location is shown by a circle on the aft side (Figure 14, Section 4.1).

TABLE VII

TITANIUM/CADMIUM COMBINATIONS ON TA-7C[1]

Item No.	Part Number	Titanium Part Description	Cadmium Plated Component	Pressure	Temperature	Sealant or Paint Barrier Between Cadmium & Titanium
			I. LANDING GEAR			
1	215-24833-1	Beam Spring	NAS 1308-60 (Bolt) 202-15522-8-23 (Bolt) 215-24307-1 (Bolt)	Bolt torque	Ambient	None
2	215-244107-7-8-9-10-11-12-13 & 14	Launch Bar Spring	NAS 464P4A28 (Bolt) 215-24817-1 (Bolt)	Bolt torque	Ambient	None
3	215-24485-1&-13	Launch Bar Spring	NAS 464P4A28 (Bolt) 215-24817-1 (bolt)	Bolt torque	Ambient	None
4	215-24495-1	Leaf Spring, outer Housing	NAS 464P3-11 (bolt) NAS 464P3-18 (bolt)	Bolt Torque	Ambient	None
			II. ENVIRONMENTAL			
5	215-36369-17 through -22	Air Conditioning Exhaust Duct	MS20601MP5-2 (Rivets)	Rivet Pressure	Approx. 300°F Maximum	None
			III. CONTROL SURFACES			
6	215-60206-9-10-19-20 & 216-60206-3 & 4 (2)	UHT Leading Edge	202-17500 HP Blind Fastener (Sleeves only)	Pull up Pressure of Sleeve	Ambient	None
			IV. FUSELAGE			
7.	216-40040-20 & 29 (2)	Frame Assy. Engine Access Door	NAS 1202-9 (Bolt)	Bolt Torque	Approx. 350°F Maximum	Titanium Alodined and Primed. Fasteners not installed wet.
			V. POWER PLANT			
8	215-55129-2 & 3 (2)	Fwd. Engine Mount Link	215-55415-1(Bolt) AN960-1216(Washer) (Washer in Contact with Titanium) CPC1633 Bearing, Cad. Plated OD & Ends	Bolt Torque Bolt Torque	250°F Max.	None
9	210-33549-4-5&-6	Stud	Cad Plated Nut	Nut Pressure	Ambient	None
10	215-33491-2	Stud	Cad. Plated Nut Plate	Nut Pressure	Ambient	None
11	215-33431-7-8&-10	Stud	Cad Plated Nut	Nut Pressure	Ambient	None
12	NAS 673V	Bolt	Cad Plated Nut	Nut Pressure	Ambient	None

(1) Vendor Parts Not Reviewed

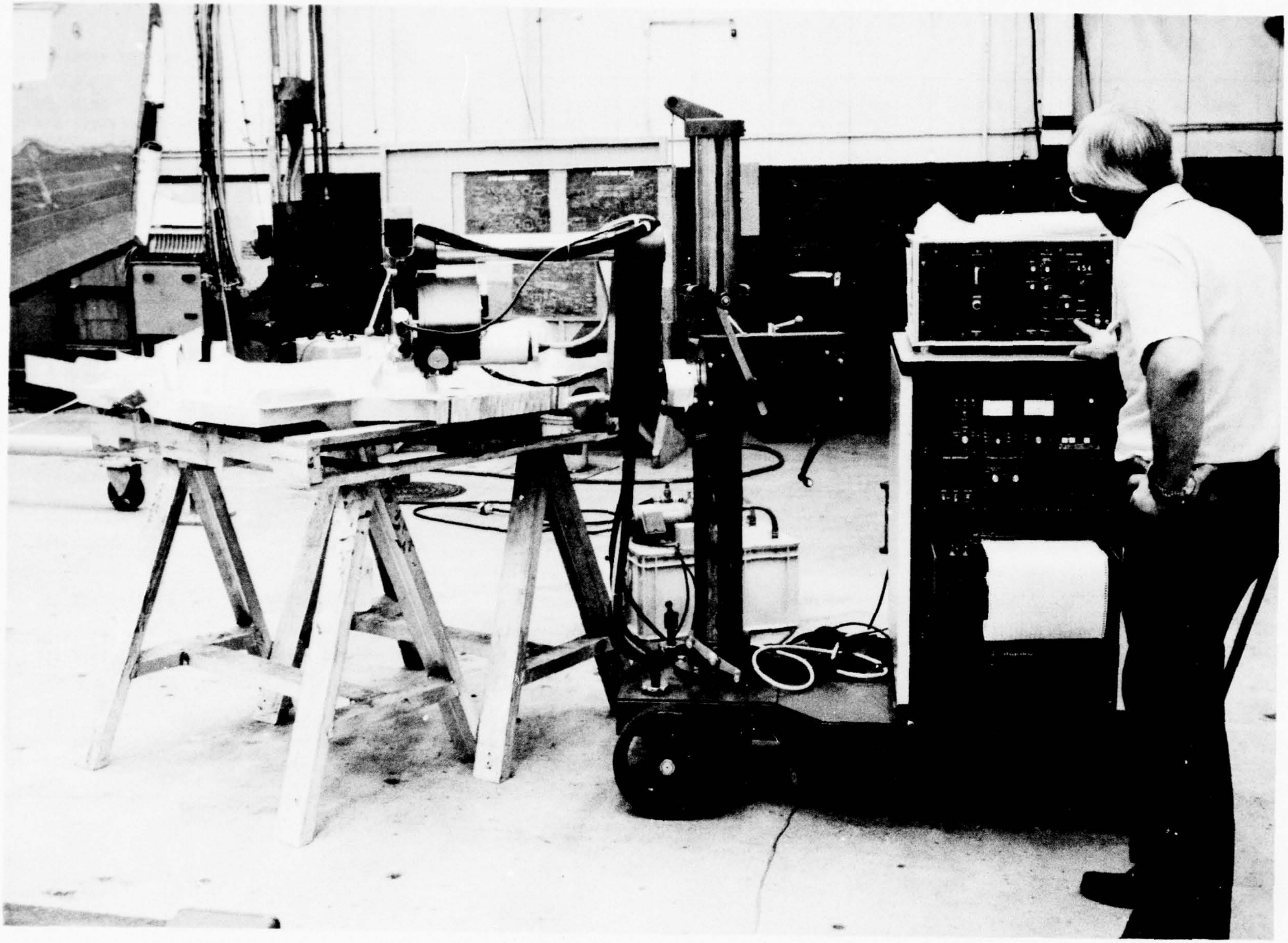


FIGURE 10. RIGAKU STRAINFLEX UNIT IN OPERATION ON 215-30402 BULKHEAD FITTING.

ALUMINUM PARTS

215-20410-6	Mount, Forward Looking Radar NFS
215-24031	Housing Assembly, Shock Strut Cylinder, NLG
215-70410-1	Extension, Wingfold Rib, Center Wing Section
215-30401-1	Bulkhead, Sect. Wing Attach Sta. 480
215-30402	Bulkhead, Sect. MLG Attach Sta. 490.5
215-70325	Rib Assembly Flap Support Ctr. Wing Sect. T.E., Inboard
215-70326	Rib Assembly, Flap Hinge Ctr. Wing Sect. Outboard
215-40402	Support Vertical Stabilizer - Aft Fuselage Section
215-70100	Rib, Trailing Edge, Center Wing Section
218-30507	Keel, Mid Fuselage Section

STEEL PARTS

215-60210	Housing, Bearing Horizontal Stab.
CV15-160516	UHT Shaft Forging
CV15-160033	UHT Shaft
215-24021	Beam Assembly, Axle NLG
CV15-160059	UHT Horn
210-22501	Bearing Unit, Plain, Rod End - Actuating Cylinder Nose Gear Steering
215-24488	Shoulder Bolt, Drag Brace Downlock, NLG
215-44454	Bumper Pin, Link Attach Arresting Gear

FIGURE 11. LIST OF PARTS SURVEYED FOR POSSIBLE RESIDUAL STRESS ANALYSIS.

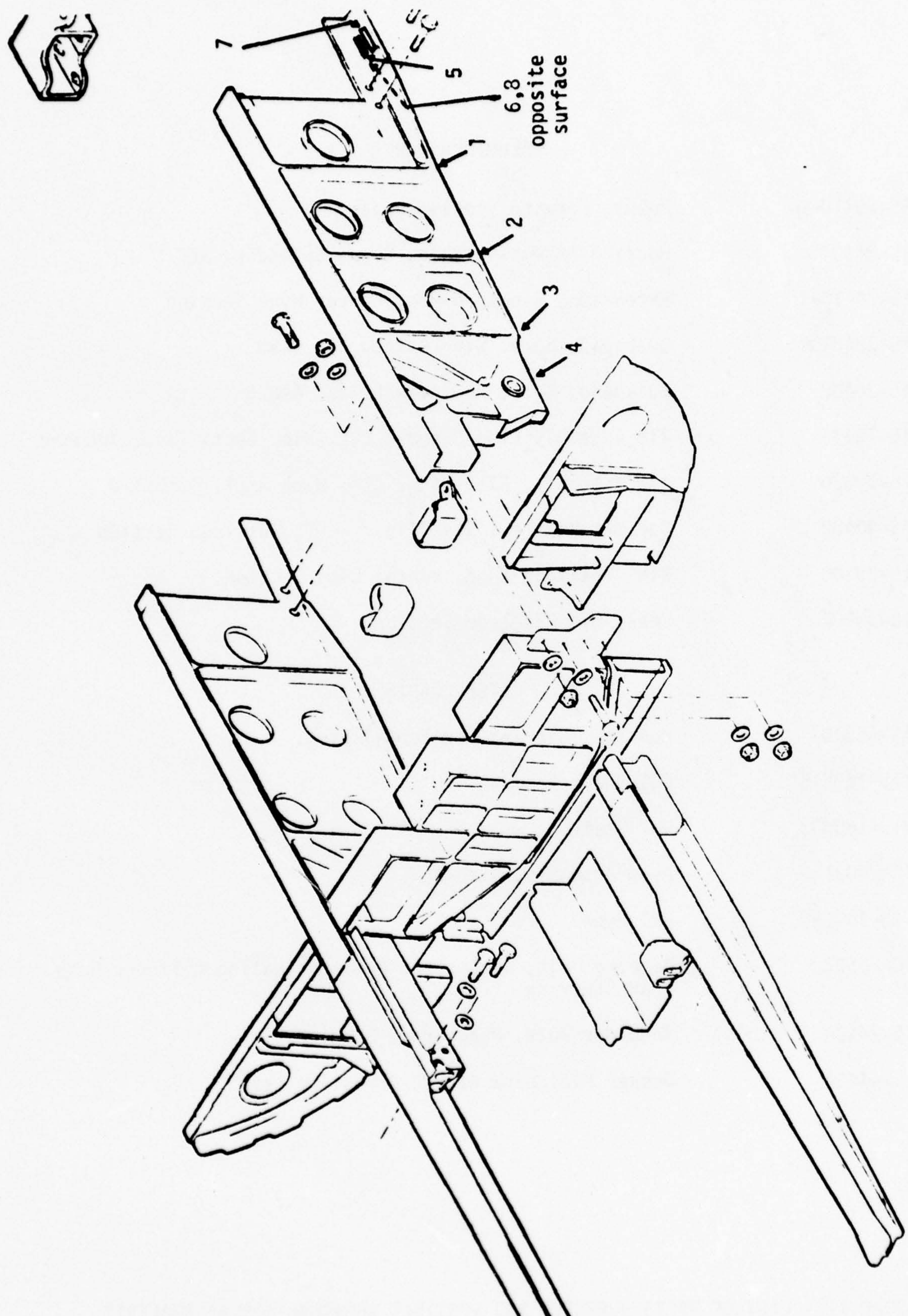


FIGURE 12. 218-30507 KEEL FITTING.

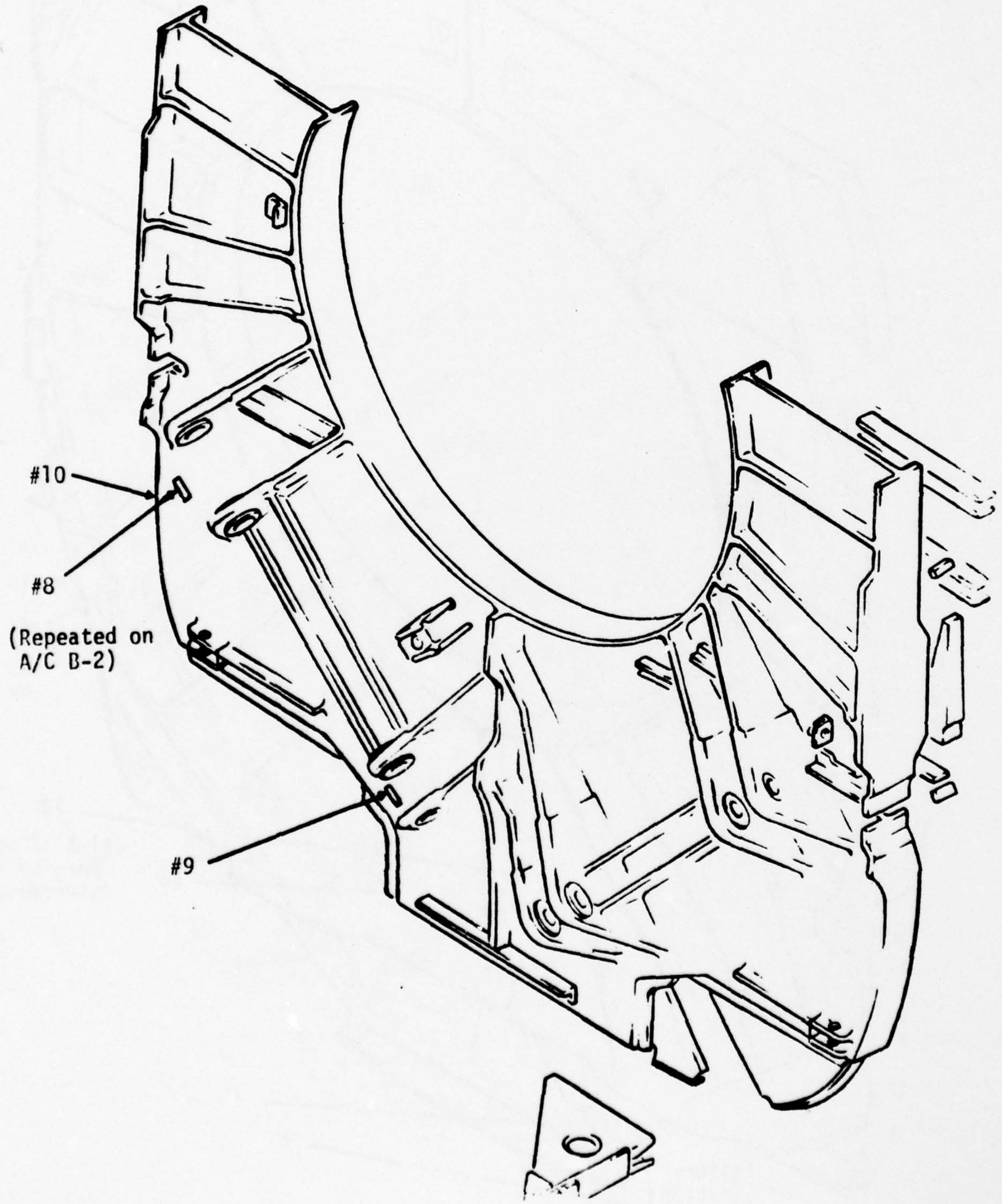


FIGURE 13. 215-30402 BULKHEAD FITTING FORWARD SIDE, AS MACHINED.

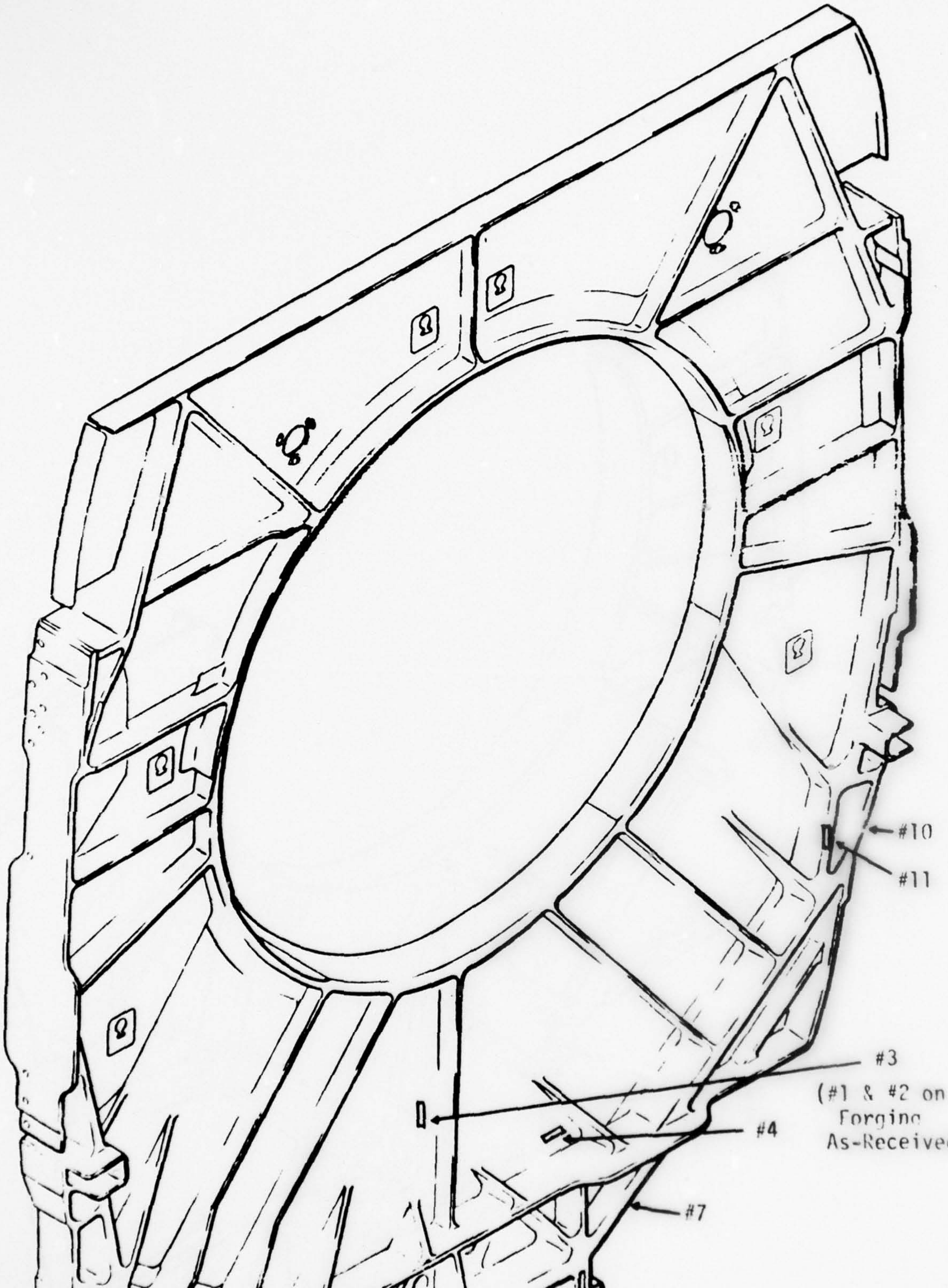


FIGURE 14. 215-30402 BULKHEAD, AFT SIDE, AS-MACHINED.

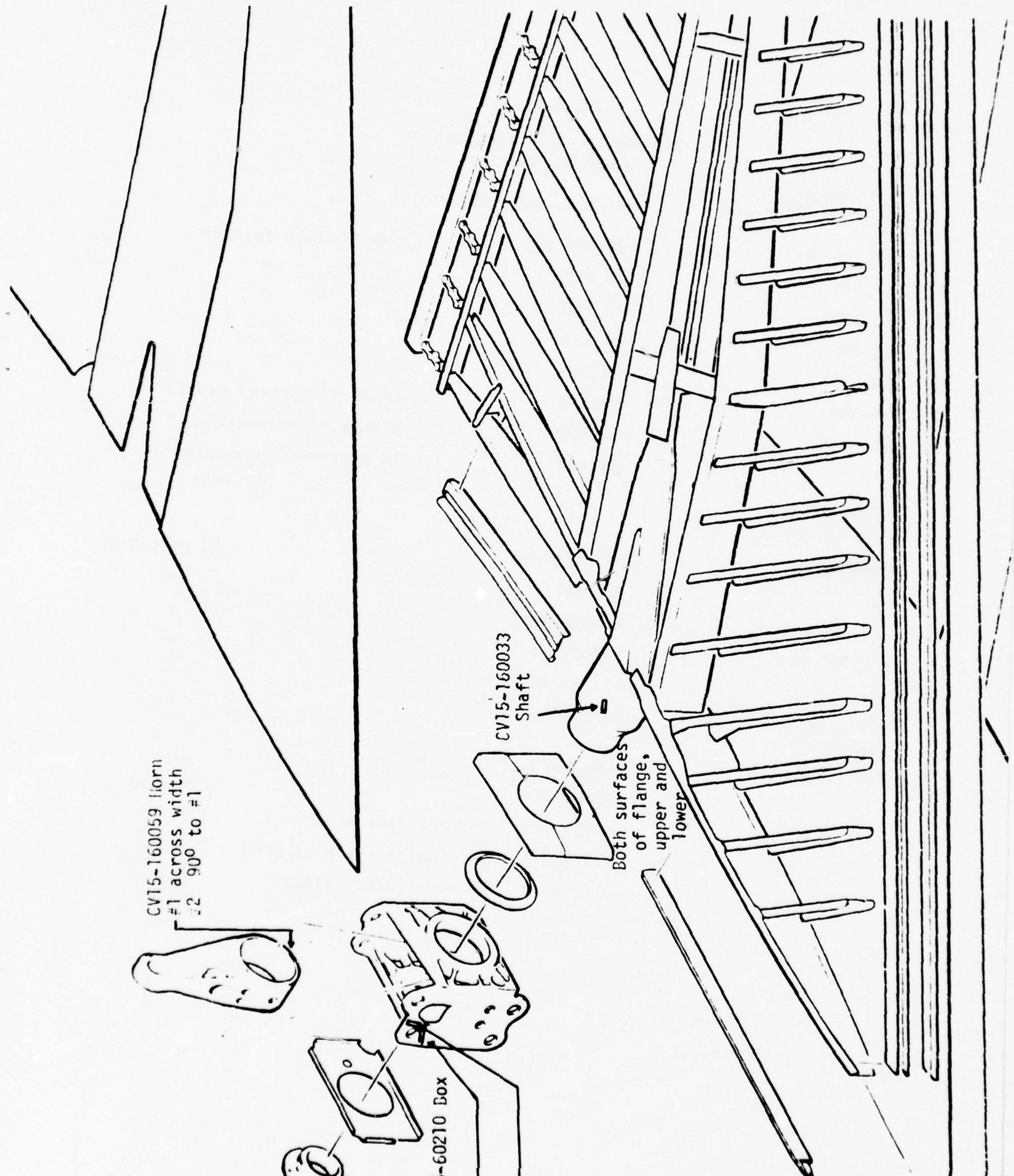


FIGURE 15. UHT ASSEMBLY.

TABLE VIII

RESIDUAL STRESS ANALYSIS OF ALUMINUM PARTS

	218-30507 OLD KEEL (FROM A/C)	NEW KEEL (AS MACHINED)	
1.	-30,780 psi	-20,925 psi	along bottom surface
2.	-19,575	-20,790	"
3.	-23,760	-13,500	"
4.	-28,026	-16,875	"
5.	-18,495	-29,700	"
6.	Cracked	-33,075	(area of typical crack)
7.	Not taken	- 6,480	Flange of protrusion
8.		-27,000	In corner of protrusion

215-30402
490 BULKHEAD

	Forging	As Machined		On ship B-2
1.	-0-	Not taken		-
2.	-10,800 psi	Not taken		-
3.	+ 2,700 psi	+7155 psi		-
4.	-0-	-1,188 psi		-
6.	Not able to get two readings	-28,080		-
7.	Not taken	-14,850		-
8.	"	-24,300		-36,450
9.	"	+4455 psi	on boss (aft side)	-
10.	"	-15,580	vertical surface of boss	-
11.	"	+15,525	on boss (aft side)	-

+ Tension

- Compression

TABLE IX

RESIDUAL STRESS ANALYSIS OF STEEL PARTS (FROM H-15 AIRCRAFT)

CV15-160059

UHT HORN - EXTERIOR OF LARGE RING

1. -114 ksi
2. -100 ksi

UHT SHAFT - ON CYLINDRICAL SECTION

1. -136 ksi

215-60210

UHT BOX - ON ONE TAB.

1. -150 ksi
2. 140 ksi (90° to no. 1)

CV15-160033

UHT SHAFT (P/N 1324) on "I" BEAM FLANGE

1. -120 ksi
2. 115 ksi
3. -163 ksi
4. -125 ksi
5. -173 ksi with pin (.002" interference) -267 ksi

UHT SHAFT (From Set #3200)

Flange Area (Outer Surface)	(Inner Surface)
1. -115 ksi	1. -113 ksi
2. -112 ksi	2. -119 ksi
3. -111 ksi	3. -39 ksi (edge of flange)
4. -110 ksi	
5. -136 ksi	**Near Holes**
6. -120 ksi	1. -72 ksi
	2. -91 ksi
	3. -77 ksi
	4. -77 ksi
	5. -88 ksi
+ Tension	6. -78 ksi (narrow slit, same hole as 3)
- Compression	7. -78 ksi (narrow slit, same hole as 2)

MODEL	ENGINEERING TEST REPORT	REPORT NO.
A7		77-53400-057
WITNESS OR APPROVALS		DATE 1 July 1977
LTV A E Hohman		TESTED BY W. W. Ladyman
	LABORATORY ENGINEERING MATERIALS & PROCESSES	REPORTED BY W. W. Ladyman WWL
CUSTOMER		APPROVED BY

TITLE RESIDUAL STRESS ANALYSIS, UHT SHAFT - CV15-160033

DISTRIBUTION: S. E. Klein, J. W. Beeler, L. E. Boswell, A. E. Hohman, S. Yarbrough

INTRODUCTION

Failure of the UHT shaft on an older A7E wherein the aircraft was lost has led into an investigation of this part to determine the extent of cracking on aircraft in service and the cause. Early, it was not known if a cracked part could be detected, so part of this work was intended to create a crack in a part and submit it to NDT for study. Further, if cracks existed, was the cause stress corrosion or were they due to some other phenomena?

Fabrication of this part is done at a subcontractor's shop and consists of machining to final dimensions, stress relief by both heating and shot peening after solution heat treatment and straightening. The part is then given a coating of cadmium deposited by vacuum plating. This part design is one that is relatively old as it was originally designed for use on the F8U-1 aircraft and this incident is the first time that this particular problem has been experienced.

OBJECTIVE

To conduct various experiments on the A-7 UHT shaft (CV15-160033) with the Rigaku Strainflex residual stress analyzer which will support the investigation of the failure of part number S/N 4032. Specific experiments include:

1. Creation of a crack for NDT examination.

2. Determination of stress due to exfoliation corrosion of the aluminum skin.

3. Clamp-up test of UHT shaft S/N 3154.

4. Depth of penetration of compressive layer.

5. Residual stress due to final straightening operation.

CONCLUSION

1. A .250" long crack was created by applying stress to a pre-slotted hole in a salt spray environment in four days.

2. Stress due to interference caused by a build-up of corrosion products

from the aluminum skin is sufficient to cause stress corrosion cracking of the steel flange with proper torque on the fasteners surrounding the corroded area.

3. Stress due to improper fit-up of the skin and flange of the shaft can be enough to cause stress corrosion cracking with normal torque on the fasteners in the immediate area surrounding the misfit condition.

4. The depth of penetration of the compressive layer was tracked to a depth of 0.010" and found to be linear with depth. Actual tensile stresses were not found in this test, however, the compressive stress was lowered from ≡ -120 KSI to -15 KSI.

PROCEDURE

1. Creation of Crack for NDT Examination

UHT shaft S/N 1324 was obtained from stores as an odd piece (the UHT Horn and Shaft are made in matched sets). The cadmium plating was removed from the upper and lower surface in the area around the four most inboard holes on the lower forward flange using a 10 percent solution of ammonium nitrate. Using fine grit paper (number 240, 320, 400, 600) the surface was polished to remove any milling marks and to provide a flat surface. The residual stress was determined in the area between the two most inboard holes on the lower flange and found to be approximately -163 KSI on the inner surface and -125 KSI on the outer surface. (This high compressive stress was probably due to the shot peening treatment.)

The hole was then measured and found to be 0.3140 in diameter. A one inch long pin with hardness of Rc 60 and which had a taper of 0.01"/inch with a minimum diameter of 0.3120" and maximum diameter of 0.3220" was obtained from the tooling machine shop. Prior to installing this pin in the hole, a slot 0.005" wide and 0.50" deep was machined by EDM in the aft side of the hole in the shaft (Figure 1). It was hoped that this slot would serve as a stress riser and initiate the desired crack. The pin was then installed to a depth which was equivalent to 0.002" interference (≡ 150 KSI tensile stress to the hole periphery).

A second residual stress measurement was then made in the same location as the first. The residual stress had changed to -267 KSI, still in compression but approximately 100 KSI greater.

With this stress being exerted on the hole, and after applying wax to mask off all the part except the area immediately around the hole, the part was placed in the salt spray cabinet for 72 hours.

After this exposure, the surface near the slot was carefully inspected using a 30X glass. There was no evidence of a crack at this time. The pin was then pressed into the hole 0.1" more, or a total of 0.003" interference. In three hours, the surface was inspected again and found to have a crack approximately 0.250" long. The part was then submitted to Quality Control for NDI to verify the crack and for their use in developing an x-ray technique for field use.

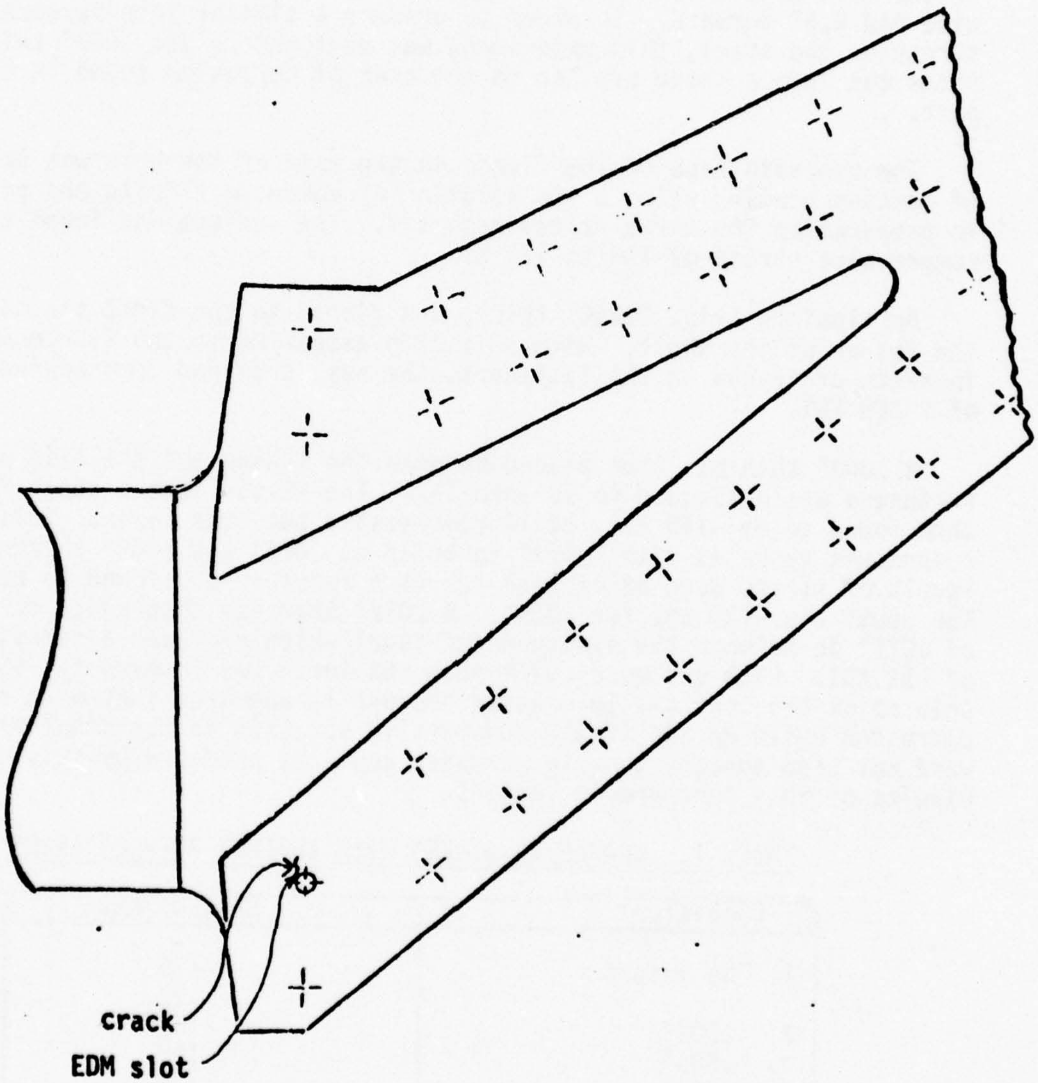


FIGURE 1. LOCATION OF HOLE IN LOWER FLANGE IN WHICH CRACK WAS INITIATED.

2. Stress Due to Exfoliation Corrosion of the Aluminum Skin

UHT shaft S/N 1324 was used in this experiment to prove that sufficient stress can be produced to cause stress corrosion cracking by the added thickness of the corrosion products from exfoliation corrosion of the aluminum skin. Inspection of one of the failed parts from service aircraft indicated that corrosion of the aluminum had progressed from the forward edge of the hole most inboard on the lower flange in an area approximately 0.375" wide and 0.5" forward. In order to produce a similar interference and put stress on the steel, this experiment was designed to use .003" thick brass shims cut into a shape similar to the area of corrosion found in the failed part.

The opposite face of the flange in the area of the hole was stripped of cadmium plating using a 10% solution of ammonium nitrate and polished in preparation for x-ray stress analysis. The surface was found to have compressive stress of 110 to 120 KSI.

An aluminum skin, 0.250" thick, was fitted to the first six holes of the flange of the shaft. With this skin assembled to the flange using 90 inch/lbs of torque on the fasteners, the same area had compressive stress of ≡ 200 KSI.

A .003" shim was then placed between the flange and the skin and the fasteners again torqued to 90 inch/lbs. The stress in the steel face was then found to be -158 KSI, still compressive but much lower. This procedure was repeated with 0.003" to build up .006" and .009" thickness. The levels of stress were determined for each assembly and found to be -128 KSI for .006" and -120 KSI for .009". A .012" shim was then added for a total of .021" in between the aluminum and steel which produced a stress reading of -62 KSI. With one more .012" shim the level was lowered to -15 KSI. At this point the test was terminated because it appeared that with sufficient corrosion build up and if the compressive stresses in the steel flange face were not high enough, tensile stresses could be produced by this phenomenon. Results of this test are in Table I.

TABLE I. CHANGE IN STRESS WITH INSERTS BETWEEN SKINS

Condition	Stress, KSI
1. No insert	-206 -198
2. .003"	-158
3. .006"	-128
4. .009"	-120
5. .021"	- 62
6. .033"	- 15

3. **Clamp Up Test of UHT Shaft S/N 3154**

UHT shaft S/N 3154 was found to have cracks when inspected at NARF-JAX. It was returned to Dallas for failure analysis. Inspection of the part indicated that the skin had only made line contact on the radius of the steel offset rather than lying flat on face of the flange. It was theorized that if this were true, the flange would have unusual stresses when proper torque was placed on the bolts during assembly. In order to prove this, a skin was fabricated, which, when assembled to the first 10 holes in the flange that had cracked, would also fit the mark left by the original skin where it made line contact. It was hypothesized that with the bolts torqued as on assembly, a change in stress could be seen.

The flange was stripped of cadmium plate on the surface opposite the skin. The steel surface was then polished in preparation for x-ray stress analysis.

Residual stress in this surface was determined to average -205 KSI (compressive) in five locations. It should be noted that the normal technique for measuring this stress had to be slightly modified due to the shape of the part. Ordinarily the ψ angles of 45^o, 30^o, 15^o, and 0^o are used; however, it was not possible to obtain any angle less than 30^o. The first reading was changed to 60^o, the greatest angle possible, then 50^o, 40^o, and 30^o. Consistent results were obtained using this technique, although there appears to be no other results reported taken in this range of angles.

The skin was then assembled to the flange and the bolts torqued to 90 inch/lbs. The residual stress was then determined in the five locations as before the assembly and found to have been reduced to an average of -187 KSI (compression).

At this point, two specific locations were chosen where the maximum change was expected and readings made before and after assembly.

Before	After
-216 KSI	-271 KSI
-203 KSI	-273 KSI

This difference is believed to be significant.

4. Depth of Penetration of Shot Peen Compressive Layer

All residual stress determinations made on the undisturbed surfaces of the UHT shafts to date have shown that the surfaces are in compression. The failure in service indicates a tensile stress is present. This test was designed to determine the depth of penetration of the compressive layer by residual stress readings after removal of .001" of the surface by electro-etching in successive steps.

The cadmium plating was removed from six areas on the flange approximately 1.00" square of UHT shaft S/N 1324. An electrode was fabricated from aluminum tubing 1.00" in diameter and 0.75" long. This electrode was placed in a dam of plastic putty which had been formed around the area to be etched. The tube electrode was made the anode and the part was made the cathode. The tube was filled with a solution of Glacial Acetic/Perchloric Acid, mixed 10:1 by volume.

15 - 20 volts DC were applied which yielded a current of 0.5 to 1.0 amp. This current was maintained by manually (acid bursh) removing the oxide buildup for five minutes.

The thickness of the flange was determined using sheet metal micrometers before and after each successive step. This was found to be inaccurate and a more accurate method was incorporated at the final step which involved spring loaded calipers and a 0.100" gauge block. Results of this test are in Table II and Figure 2.

5. Residual Stress Due to Final Straightening Operation

A UHT-shaft which had no serial number but was in the Structures Test Lab storage area was used in this experiment. Although the history of this part was not known, it was of the proper metal alloy, configuration, and hardness. The experiment was designed to determine the magnitude of stresses induced by the bending necessary in performing the final straightening of the part after heat treatment.

Residual stress measurements were made as shown in Figure 3 before any bending. Seven locations were picked for analysis - five on the upper flange and two on the lower flange. The part was then submitted to the Structures Test Lab where strain gauges were installed and the upper flange of the part was bent sufficiently to cause a change in deflection of 0.03". Microstrain was determined from the strain gauges and a permanent change in stress of 10,000 psi was computed.

The part was then returned for residual stress measurements. These were made in the same seven sites and found to have changed only on the upper flange. Results of these determinations are in Table III.

TABLE II

DEPTH OF PENETRATION OF SHOT PEEN COMPRESSIVE LAYER

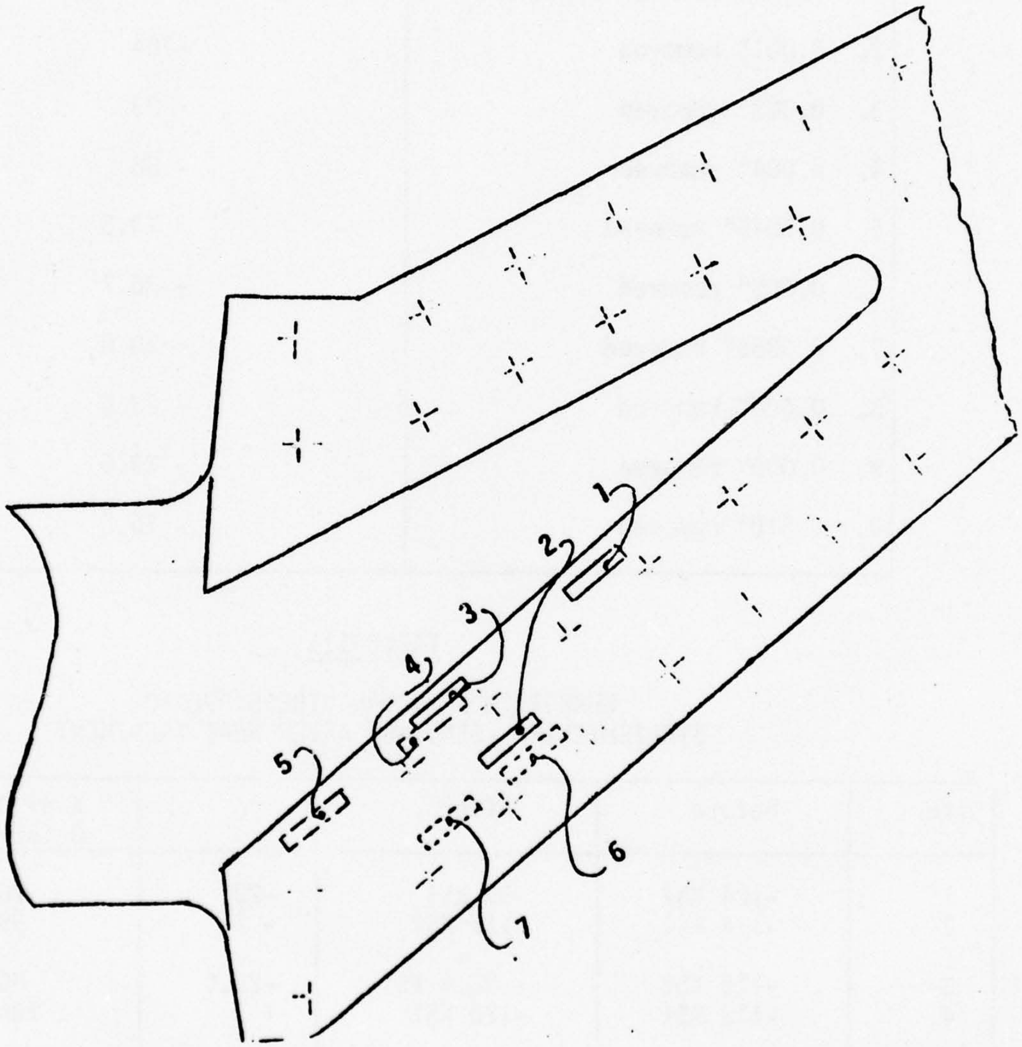
CONDITI[illegible]	RESIDUAL STRESS, KSI
1. Surface after removal of Vacuum Cadmium Plate	-116
2. 0.001" removed	-104
3. 0.002" removed	- 83
4. 0.004" removed	- 88
5. 0.0045" removed	- 73.5
6. 0.005" removed	- 36.7
7. 0.0065" removed	- 28.8
8. 0.008" removed	- 23.6
9. 0.009" removed	- 23.6
10. 0.010" removed	- 15.0

TABLE III

CHANGE IN RESIDUAL STRESS DUE TO STRAIGHTENING (BENDING) AFTER HEAT TREATMENT

Site	Before	After	Δ	% of Original Determination
1	-124 KSI	-95 KSI	-29	76.6
2	-114 KSI	-112 KSI	- 2	98.2
3	-115 KSI	- 92.4 KSI	-22.6	80.3
4	-113 KSI	-120 KSI	+ 7	106.0
5	-115 KSI	-122 KSI	+ 7	106.0
6*	-158 KSI	-181 KSI	+23	115.0
7*	-149 KSI	-169 KSI	+20	113.0

* Note: Readings 6 and 7 were made using ψ angles of 40° to 60°. While the actual residual stress may be inaccurate, it is believed the difference in before and after may be relied upon.



1, 2, 3 - Upper flange, upper surface.
4, 5, - Lower flange, lower surface.
6, 7, - Upper flange, lower surface (6 opposite 2).

FIGURE 2

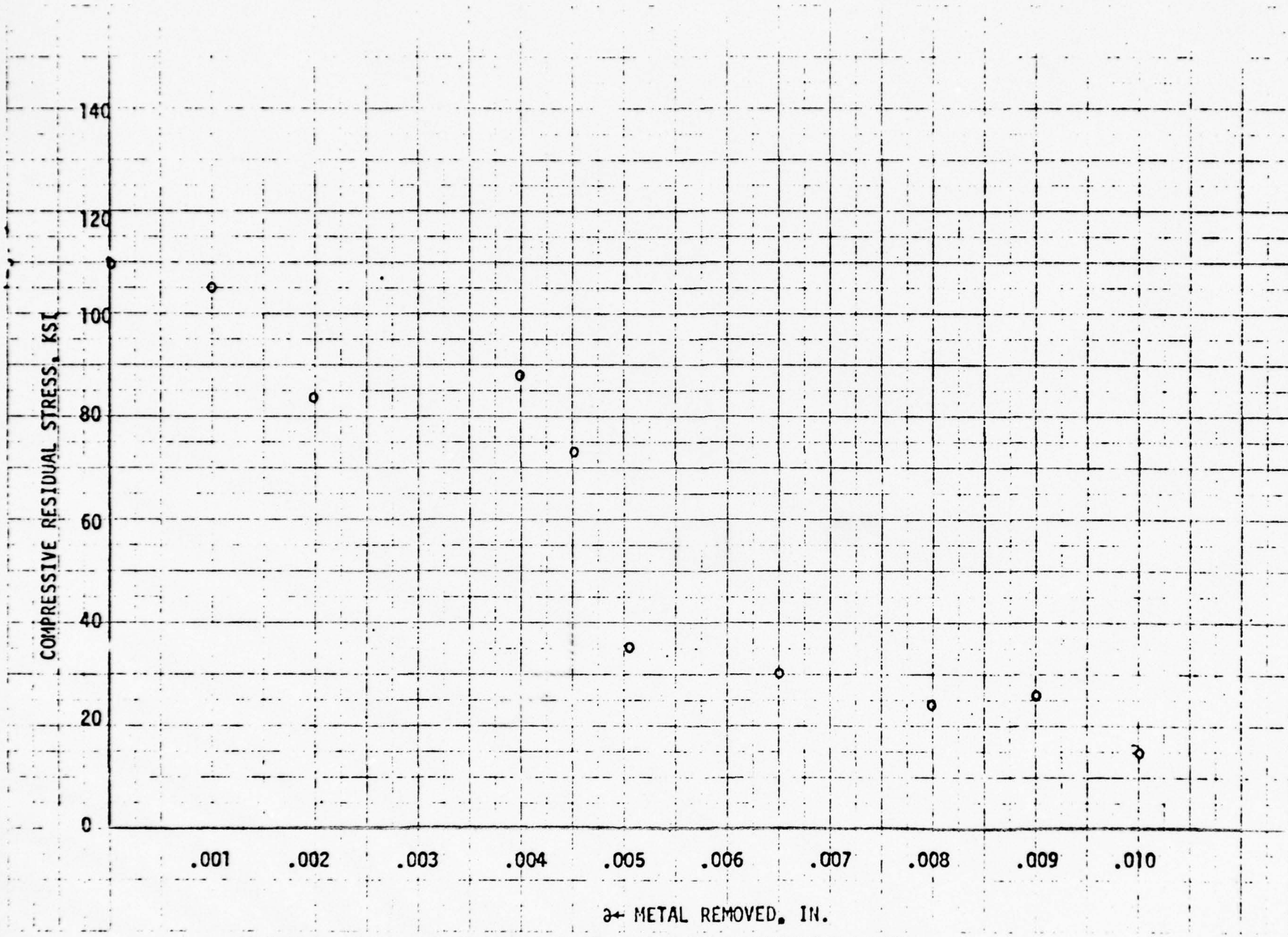


FIGURE 3. DEPTH OF PENETRATION OF SHOT PEEN COMPRESSIVE LAYER

5.0 SUMMARY AND RECOMMENDATIONS

The rating system developed in this program is effective in highlighting parts that are prone to stress corrosion cracking.

Residual stress analysis using the Rigaku Strainflex Analyzer is valuable in determining actual surface residual stress in parts where access to the area in question can be achieved. Design improvements in the equipment are necessary to optimize its value as a tool in exploratory and production work. A smaller size head with more flexibility would be the main requirement. In addition more work needs to be accomplished in the area of specimen preparation. A standard procedure is mandatory so that readings are repeatable and consistent.

Inspection criteria and corrective measures have been established for SCC prone parts. Inspection choices are indicated from the more simple to the more difficult in order to allow for flexibility. Corrective measures are suggested that are most easily achieved in the fleet.

Consideration should be given to changing SCC prone parts of high criticality, i.e., 9 or 10 to SCC resistant alloy/temper combinations.

Consideration should be given to adding detailed NDI procedures on critical SCC prone parts to Technical Manual NAVAIR 01-45AAA-3-3.1, "Non Destructive Inspection Procedures, A-7 Series Aircraft."

The use of aluminum to protect stress corrosion cracking prone aluminum parts should be pursued. Flame or plasma spray is a present capability for Naval Air Repair Facilities. The ion vapor deposition process requires standardization and development of a process specification. Limitations need to be defined so that optimum use can be made of this process in the maintenance of Navy aircraft.

6.0 REFERENCES

1. "Resistance of Wrought High-Strength Aluminum Alloys to Stress Corrosion," by D. O. Sprowls and R. H. Brown, dtd 1962, Aluminum Company of America.

2. "Sustained Load Cracking of Ti Plated Titanium Hi-Lok Fasteners," R. Marler, Grumman Aircraft. (Paper presented at DMIC Meeting, 1969).

3. Vought Corporation, Systems Division Lab Report 74-53452-042, 19 March 1974.

4. SPS Technical Report No. 1880, October 19, 1969.

5. Fager, D. N. and W. T. Spuer, "Solid Cadmium Embrittlement: Titanium Alloys," Corrosion 26, 409 (1970) October.

RATING FACTORS

Material - MATL
Heat Treatment - H.T.
Initial Thickness - THICK.
Stock Removal - STOCK REM.
Grain Direction - GRAIN
Surface Treatment - SURF.
Notch Factor - KT
Threaded part - THREADS
Press Fit bushing - PRESS FIT.
Angularity - ANGULAR
Pressure Loading - PRESS.
Sustained Loading - SUSTAIN
Assembly Loading - ASSY.

INSPECTION

NUMERICAL PART LIST, STRESS CORROSION SUSCEPTIBLE PARTS FIGURE 17

A. Accessibility

1. Failure prone area readily visible.
2. Component/assembly removal required.
3. Failure prone area visible by removal of inspection covers, fairings, access panels, etc.
4. Failure prone area covered by structure/skin.
5. Failure prone area accessible with difficulty, (crawling inside wing, etc) or accessible upon removal of adjacent hardware or equipment.
10. Failure prone area buried, major disassembly req.

* Taper pin

B. Difficulty

1. In place simple
2. In place difficult
3. In place after obstruction removal - simple
4. In place after obstruction removal - difficult
5. As part of removed subassembly - simple.
6. As part of removed subassembly - difficult
7. After major subassembly - simple
8. After major subassembly - difficult

Refer to CVA TB-21 Technical Bulletin
** Finish Code Numbers HL - hard landing effect

C. Method

1. visual
2. penetrant
3. ultrasonic
4. eddy current
5. x-ray
6. other

PART NUMBER	NOMENCLATURE	FORM MATL.	IPB NAVAIR 01-45AAF VOL.	IPB FIGURE	IPB INDEX	SRM NAVAIR 01-45AAA VOL.	SRM FIGURE	SRM INDEX	NEXT ASSEMBLY	MATL	THICK	H.T.	STOCK REM.	GRAIN	SURF.	KT	THREADS	PRESS FIT	ANGULAR	PRESS	SUSTAIN	ASSY.	SCC RATING	CRITICALITY RATING	SCC FAILURE OCCURRENCE	INSPECTION A	INSPECTION B	INSPECTION C	IMPROVEMENT METHOD - NOTES **
CV15-160033	Shaft, UHT	Forg. 4340	-	-	-	3-2	5-28	4	216-60200			45				20	1	10*	5		10	5	80	10	yes	2 phase/ depot	5	5	--- Add sealant at faying surface; MIL-S-8802
215-20408	Support Assy. A/C Ejection Seat-Cockpit	Plate 7075				3-2 2	6-66	45	220-20300	20	8	5			-5			15	10			12	80	3	--	6 depot	3	1/2	Seal bushing - Seal per Spec. CVA6-177(12)
215-20410	Mounts, Forward Looking Radar NFS	Bar 7075				3-2 2	6-26	39	215-20030	20	10	10	15	20	-3			20		HL		10	102	1	--	3 phase	3	1	Chamfer before sealing - 1. Stress analysis required. 2. Seal per Spec. CVA6-177(12)
215-24021	Beam Assy., Axle NLG	Forg. 4340	4-4	014	73				--			30			5	15	15	20		HL	10		95	10	-	1 phase	1	2/3 /4	Corrosion preventative - At each inspection interval in suspect areas.
215-20431	Housing Assy. Shock Strut Cyl. NLG	Forg. 7075				3-2	1-40	18	--	20	10	10	20		-10		10	20		HL	10		95	10	yes	1 phase	1	2/3 /4	Trunnion (1) & (2) Nameplate (3) - 1. IVD + 365-2CT + Corr. preventative if removed. 2. Corr. prevent. in crevices if not removed. 3. MIL-S-8802 sealant under nameplate.
215-24032	NLG Shock Strut Cylinder	Forg. 7075				3-2	1-40	3	215-24030	20	10	10	20		-10		10	20		HL	10		95	10	yes	2 depot	5	2/4	IVD (A1) plus corrosion preventative
215-24488	Bolt Shoulder Drag Brace Down Lock NLG	Bar Marag 280	4-4	017	27				215-24070			45			5	15	10					5	80	3	--	2 phase	3	2	Vac. cad. plate radius and 365-1CT
215-30080	Support, Drag Strut MLG MFS	Forg. 7075	4-2	069	-				215-30068	20	10	8		20	-13			20		HL		20	85	10	--	1 phase	1	1/3	Check bushings grease flow
215-30401	Bulkhead Sect, Wing Attach, STA 480	Forg 7075	4-2	076	12+ 13	3-2	6-114	1	215-30078 220-30024	20	10	10		20	-13			5	15		10	15	92	10	yes	6 depot	4	4	IVD(A1)
215-30402	Bulkhead Sect. MLG Attach STA 490.5	Forg. 7075	4-2	077	22	3-2	6-124	79	215-30079 220-30025A 215-30025B	20	10	10		20	-13			5	15	HL	1)	17	94	10	yes	6 phase	2	1/4	Fair water trap area, MIL-S-8802 Prone Area - 215-30079 shown

NUMERICAL PART LIST, STRESS CORROSION SUSCEPTIBLE PARTS

RATING FACTORS

Material - MATL
Heat Treatment - H.T.
Initial Thickness - THICK.
Stock Removal - STOCK REM.
Grain Direction - GRAIN
Surface Treatment - SURF.
Notch Factor - KT
Threaded part - THREADS
Press Fit bushing - PRESS FIT.
Angularity - ANGULAR
Pressure Loading - PRESS.
Sustained Loading - SUSTAIN
Assembly Loading - ASSY.

INSPECTION

A. Accessibility

1. Failure prone area readily visible.
2. Component/assembly removal required.
3. Failure prone area visible by removal of inspection covers, fairings, access panels, etc.
4. Failure prone area covered by structure/skin.
5. Failure prone area accessible with difficulty, (crawling inside wing, etc) or accessible upon removal of adjacent hardware or equipment.
10. Failure prone area buried, major disassembly req.

* Taper pin

B. Difficulty

1. In place simple
2. In place difficult
3. In place after obstruction removal - simple
4. In place after obstruction removal - difficult
5. As part of removed subassembly - simple.
6. As part of removed subassembly - difficult
7. After major subassembly - simple
8. After major subassembly - difficult

Refer to CVA TB-21 Technical Bulletin
** Finish Code Numbers HL - hard landing effect

C. Method

1. visual
2. penetrant
3. ultrasonic
4. eddy current
5. x-ray
6. other

PART NUMBER	NOMENCLATURE	FORM / MATL.	IPD NAVAIR 01-45AAF VOL.	IPD FIGURE	IPD INDEX	SRM NAVAIR 01-45AAA VOL.	SRM FIGURE	SRM INDEX	NEXT ASSEMBLY	MATL	THICK	H.T.	STOCK REM.	GRAIN	SURF.	KT	THREADS	PRESS FIT	ANGULAR	PRESS	SUSTAIN	ASSY.	SCC RATING	CRITICALITY RATING	SCC FAILURE OCCURRENCE	INSPECTION A	B	C	IMPROVEMENT METHOD - NOTES **
215-30407	Bulkhead Sect. MLG Attach, STA 490.5	Forg. 7075	4-2	078	21	3-2	6-124	1	215-30027 220-30025A 215-30025B	20	10	10		20	-13					HL	10	15	87	10	--	3 depot	1	5	Corrosion preventative - Prone area 215-30027 IVD if disassembled
215-30420	Catapult Longeron Splice	Extr. 7075				3-2 2 3-2	6-52 6-99	98-101 125-128	218-30057 220-30057	20	4	3		20					15			20	82	5	yes	3 phase	1	1	Shim for fit - Prone area 218-30057
215-30446	Support, partition Keel-MFS STA 346.5-375	Bar 7075				3-2	6-96	77	215-30065	20	10	8	15	20	-4							12	81	7	--	3 phase	1	1	IVD (A1)
215-30482	Splice Members Brake Flap Support	Bar 7075				3-2 ,2	6-151	30+ 31	220-30072	20	8	5	15	20					20				88	5	--	3 phase	1	1/4 /5	Apply sealant - Install fasteners with MIL-S-8802 per CVA6-177(6)
215-30543	Support, Fus.Pylon MFS, FWD	Bar 7075	4-2	060	6				215-30030	20	10	8	15	20	-4				20				89	3	--	2 depot	3	4	20-1CT - When disassembled
215-30544	Support, Fus.Pylon MFS, Aft	Bar 7075	4-2	060	9				215-30030	20	10	8	15	20	-4				20				89	3	--	2 depot	3	4	20-1CT - When disassembled
215-40402	Support, Vert. Stab. AFS, STA 653.6 Side	Plate 7075	4-2	096	13				215-40023	20	8	5	15	20	-8			15				20	95	9	--	4 depot	1	5	Apply sealant - When disassembled. 1. Install fasteners with MIL-S-8802 per CVA6-177(6). 2. Faying surface sealant MIL-S-8802 per CVA6-177(1)
215-44454	Pin Bumper, Link Attach Arresting Gear	Bar Marag 280	4-4	048	8				215-44020			45			5	15	10				10		85	3	--	2 phase	3	2	--
215-60210	Housing, Bearing Horiz. Stab.	Forg. 4340				3-2	5-28	70	215-60200			45				15	10				5	5	80	9	--	10 depot	7	4	Seal faying surface - MIL-S-8802 per CVA6-177(1)

RATING FACTORS

Material - MATL
Heat Treatment - H.T.
Initial Thickness - THICK.
Stock Removal - STOCK REM.
Grain Direction - GRAIN
Surface Treatment - SURF.
Notch Factor - KT
Threaded part - THREADS
Press Fit bushing - PRESS FIT.
Angularity - ANGULAR
Pressure Loading - PRESS.
Sustained Loading - SUSTAIN
Assembly Loading - ASSY.

INSPECTION

A. Accessibility

1. Failure prone area readily visible.
2. Component/assembly removal required.
3. Failure prone area visible by removal of inspection covers, fairings, access panels, etc.
4. Failure prone area covered by structure/skin.
5. Failure prone area accessible with difficulty, (crawling inside wing, etc) or accessible upon removal of adjacent hardware or equipment.
10. Failure prone area buried, major disassembly req.

* Taper pin

NUMERICAL PART LIST, STRESS CORROSION SUSCEPTIBLE PARTS

B. Difficulty

1. In place simple
2. In place difficult
3. In place after obstruction removal - simple
4. In place after obstruction removal - difficult
5. As part of removed subassembly - simple.
6. As part of removed subassembly - difficult
7. After major subassembly - simple
8. After major subassembly - difficult

Refer to CVA TB-21 Technical Bulletin
** Finish Code Numbers HL - hard landing effect

C. Method

1. visual
2. penetrant
3. ultrasonic
4. eddy current
5. x-ray
6. other

PART NUMBER	NOMENCLATURE	FORM MATL.	IPD NAVAIR 01-45AAF VOL.	FIGURE	INDEX	SRM NAVAIR 01-45AAA VOL.	FIGURE	INDEX	NEXT ASSEMBLY	MATL	THICK	H.T.	STOCK REM.	GRAIN	SURF.	KT	THREADS	PRESS FIT	ANGULAR	PRESS	SUSTAIN	ASSY.	SCC RATING	CRITICALITY RATING	SCC FAILURE OCCURRENCE	INSPECTION A	B	C	IMPROVEMENT METHOD - NOTES **
215-70070	Support Assy. Inbd Wing Pylon-Ctr Wing Sect.	Forg 7075				3-2	4-32	21	215-70069	20	10	10	15	20	-13						5	20	87	3	-	2 depot	1	1/4	366-1CT -
215-70071	Support Assy. Center Wing Pylon	Forg. 7075				3-2	4-33	26	215-70067	20	10	10	15	20	-13						5	20	87	3	-	6 depot	1	1/4	366-1CT
215-70098	Rib, Ctr. Wing Sect. STA Y61.2	Forg	4-2	109	52				215-70052	20	10	10		20	-5		15					13	83	7	--	4 depot	1	2/5	IVD(A1)
215-70100	Rib, Trailing Edge Ctr. Wing Sect. STA Y29.5	Plate 7075				3-2	4-15	31	215-70027	20	10	8	15	20	-8			20				12	97	5	--	4 depot	1	2/5	Chamfer before sealing - Stress analysis required.
215-70101	Rib, Trailing Edge Ctr. Wing Sect STA 135	Bar 7075				3-2	4-15	7	215-70027	20	10	10		20	-11			20				15	84	3	--	4 depot	1	2/5	Chamfer before sealing - Stress analysis required.
215-70194	Outboard Flap Slot Doors	Extr. 7075	4-5	055					215-70192	20	8	4		20	--				10			20	82	5	yes	1 phase	1	1	Chamfer before sealing -T6 only. 1. Stress analysis required. 2. Seal per Specification CVA6-177(12)
215-70325	Rib Assy. Flap Support Ctr. Wing Sect. T.E. Inbd.	Forg. 7075	4-2	112	1			21	215-70055	20	10	10		20	0			15				17	92	3	--	2 phase	1	1/4	366-1CT
215-70326	Rib Assy. Flap Hinge Ctr. Wing Sect. Outbd.	Forg. 7075	4-2	112	27			21	215-70056	20	10	10		20	0			15				17	92	3	--	2 phase	1	1/4	366-1CT
215-70360	Support Assy. Spoiler Hinge Outbd Ctr. Wing Sect. T.E.	Plate 7075	4-5	021		3-2	4-19	4	215-70359	20	8	5	15	20	-5			20				3	81	5	--	2 phase	1	1/4	Chamfer before sealing - 1. Stress analysis required. 2. Seal per Spec. CVA6-177(12)

NUMERICAL PART LIST, STRESS CORROSION SUSCEPTIBLE PARTS

RATING FACTORS

Material - MATL
Heat Treatment - H.T.
Initial Thickness - THICK.
Stock Removal - STOCK REM.
Grain Direction - GRAIN
Surface Treatment - SURF.
Notch Factor - KT
Threaded part - THREADS
Press Fit bushing - PRESS FIT.
Angularity - ANGULAR
Pressure Loading - PRESS.
Sustained Loading - SUSTAIN
Assembly Loading - ASSY.

INSPECTION

A. Accessibility

1. Failure prone area readily visible.
2. Component/assembly removal required.
3. Failure prone area visible by removal of inspection covers, fairings, access panels, etc.
4. Failure prone area covered by structure/skin.
5. Failure prone area accessible with difficulty, (crawling inside wing, etc) or accessible upon removal of adjacent hardware or equipment.
10. Failure prone area buried, major disassembly req.

* Taper pin

B. Difficulty

1. In place simple
2. In place difficult
3. In place after obstruction removal - simple
4. In place after obstruction removal - difficult
5. As part of removed subassembly - simple.
6. As part of removed subassembly - difficult
7. After major subassembly - simple
8. After major subassembly - difficult

Refer to CVA TB-21 Technical Bulletin
** Finish Code Numbers HL - hard landing effect

C. Method

1. visual
2. penetrant
3. ultrasonic
4. eddy current
5. x-ray
6. other

PART NUMBER	NOMENCLATURE	FORM MATL.	IPB NAVAIR 01-45AAF VOL.	IPB FIGURE	IPB INDEX	SRM NAVAIR 01-45AAA VOL.	SRM FIGURE	SRM INDEX	NEXT ASSEMBLY	MATL	THICK	H.T.	STOCK REM.	GRAIN	SURF.	KT	THREADS	PRESS FIT	ANGULAR	PRESS	SUSTAIN	ASSY.	SCC RATING	CRITICALITY RATING	SCC FAILURE OCCURRENCE	INSPECTION A	B	C	IMPROVEMENT METHOD - NOTES **
215-70385	Support Assy. Spoiler Hinge,Ctr Wing Sect.T.E.Inbd	Plate 7075	4-5	021		3-2	4-19	8	215-70350	20	8	5	15	20	-7					20		5	86	5	--	2 phase	1	1/4	Chamfer before sealing-- 1. Stress analysis required. 2. Seal per Specification CVA6-177(12)
215-70405	Rib, Ctr.Wing Sect.Wing Attach	Forg 7075				3-2	4-2	102	215-70057	20	10	10		20	0			20			5	5	90	10	--	6 depot	4	3	NiCd plate bushings -
215-70410	Extension Wing Fold Rib CWS	Forg 7075				3-2	4-21	3,9 +31	215-70050	20	10	10	15	20	-10							17	82	5	--	4 depot	1	5	IVD(Al) plus 365-1CT - When disassembled
215-70418	Spar, CWS, Front Ctr	Plate 7075				3-2 ,2	4-5	151	215-70035	20	8	5	15	20	-8							20	80	7	yes	3 depot	1	5	20 1CT
215-70446	Spar, CWS Inter No. 3, Otbd	Plate 7075				3-2	4-2	41	215-70038	20	4	5	15	20	-3							20	81	7	--	4 depot	1	5	--- Add polyurethane fuel tank coating in fuel tank area
215-70447	Spar, CWS Inter No. 4, Inbd	Plate 7075				3-2	4-2	106	215-70039	20	8	5	15	20	-3							20	85	7	--	4 depot	1	5	--- Add polyurethane fuel tank coating in fuel tank area
215-70448	Spar, CWS Inter No. 4, Outbd.	Plate 7075				3-2	4-2	43	215-70039	20	4	5	15	20	-3							20	81	7	--	4 depot	1	5	Check for vac. cad + 365 -
215-70468	Rib,CWS STA Y97.2 STA Xw122 - Xw133	Plate 7075				3-2	4-2	55	215-70051	20	10	8	15	20	-3							12	81	5	--	4 depot	1	5	Corrosion preventative in crevices
215-80072	Hinge Assy. Ail. Outer Wing T.E. Outbd.	Plate 7075	4-2	100	49+ 58	3-2	4-25	82	215-80053	20	8	5	15	20	-8							20	80	7	--	2 phase	3	3	IVD(Al)
215-80093	Support Assy. Wing Fold Actuator Outer Wing Sect.	Bar 7075	4-2	101	7				215-80023	20	10	10	15	20	-4			5				5	81	3	--	2 phase	3	3	Chamfer before sealing - Stress analysis required

RATING FACTORS
Material - MATL
Heat Treatment - H.T.
Initial Thickness - THICK.
Stock Removal - STOCK REM.
Grain Direction - GRAIN
Surface Treatment - SURF.
Notch Factor - KT
Threaded part - THREADS
Press Fit bushing - PRESS FIT.
Angularity - ANGULAR
Pressure Loading - PRESS.
Sustained Loading - SUSTAIN
Assembly Loading - ASSY.

INSPECTION

A. Accessibility

1. Failure prone area readily visible.
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4. Failure prone area covered by structure/skin.
5. Failure prone area accessible with difficulty, (crawling inside wing, etc) or accessible upon removal of adjacent hardware or equipment.
10. Failure prone area buried, major disassembly req.

* Taper pin

NUMERICA PART LIST, STRESS CORROSION SUSCEPTIBLE PARTS

B. Difficulty

1. In place simple
2. In place difficult
3. In place after obstruction removal - simple
4. In place after obstruction removal - difficult
5. As part of removed subassembly - simple.
6. As part of removed subassembly - difficult
7. After major subassembly - simple
8. After major subassembly - difficult

Refer to CVA TB-21 Technical Bulletin
** Finish Code Numbers HL - hard landing effect

C. Method

1. visual
2. penetrant
3. ultrasonic
4. eddy current
5. x-ray
6. other

PART NUMBER	NOMENCLATURE	FORM MATL.	IPB NAVAIR 01-45AAF VOL.	FIGURE	INDEX	SRM NAVAIR 01-45AAA VOL.	FIGURE	INDEX	NEXT ASSEMBLY	MATL	THICK	H.T.	STOCK REM.	GRAIN	SURF.	KT	THREADS	PRESS FIT	ANGULAR	PRESS	SUSTAIN	ASSY.	SCC RATING	CRITICALITY RATING	SCC FAILURE OCCURRENCE	INSPECTION A	B	C	IMPROVEMENT METHOD - NOTES **
215-80200	Flap Assy. Wing Landing L.E.Outbd	Extr 7075	4-5	051/053						20	8	3	15	20	-								66	5	yes	4 depot	1	5	No change
215-80320	Hinge Assy. Aileron Ctr.	Forg 7075	4-5 4-2	010 100					215-80071 215-80054	20	10	10	15	20	-10							17	82	5	--	2 phase	3	3	Chamfer before sealing - 1. Stress analysis required 2. Seal per Specification CVA6-177(12)
215-80403	Support Wingfold Rib Outer Wing Sect.	Forg 7075	4-2	102	59	3-2	4-26	13	215-80057	20	10	10	15	20	0			20			10		105	9	yes	1 phase	1	3	Chamfer before sealing - Prone area - 215-80057 1. Stress analysis required 2. Seal per Specification CVA6-177(12)
215-80404	Spar, Outer Wing Sect. Front	Plate 7075				3-2	4-25	41	215-80035	20	8	5	15	20	-8							20	80	7	--	2 depot	3	2/3	366-1CT Add where accessible
215-88109	Bellcrank Assy. Aileron Control Outer	Bar 7075	4-5	011	77				215-88030	20	10	10	15	20	-11					20			84	5	yes	2 phase	3	1/4	Chamfer before sealing - 1. Stress analysis required 2. Seal per Specification CVA6-177(12)
220-30081	Catapult Longeron	Extr. 7075				3-2 ,2 3-2	6-152 6-99	122 54	220-30057	20	10	8	15	20	0				5	HL		10	88	10	yes	3 phase	1	2/3	New Shim & Fastener System - Prone area - 215-30057 shown

CRITICALITY RATING, TA-7C FIGURE 18

IPB NAVAIR 01-45AAF VOL.	FIG.	IND.	SRM NAVAIR 01-45AAA VOL.	FIG.	IND.	SCC RATING	C/R (1)	F/O (2)	PART NO.	NEXT ASSY.	NOMENCLATURE	INSPECTION A	B	C	IMPROVEMENT METHOD AND NOTES
4-2	069					85	10	-	215-30080	215-30068	Support, Drag Strut MLG MFS	1	1 phase	1/3	Check bushings grease flow
4-2	096	13				95	9	-	215-40402	215-40023	Support Vert. Stab. AFS STA 653.6 Side	4	1 depot	5	Apply sealant when disassembled. 1. Install fasteners with MIL-S-8802 per CVA6-177(6).2. Faying surface sealant MIL-S-8802 per CVA6-177(1)
4-2	109	52				83	7	-	215-70098	215-70052	Rib Ctr. Wing Sect. STA Y61.2	4	1 depot	2/5	IVD (A1)
4-2	100	49& 58				80	7	-	215-80072	215-80053	Hinge Assy. Aileron Outer Wing, T.E. Outbd.	2	3 phase	3	IVD (A1)
4-2	112	27				92	3	-	215-70326	215-70056	Rib Assy. Flap Hinge Ctr. Wing Sect. Outbd.	2	1 phase	1/4	366 - 1CT
4-2	112	1				92	3	-	215-70325	216-70095	Rib Assy. Flap Hinge Ctr. Wing Sect. Inbd.	2	1 phase	1/4	366 - 1CT
4-2	060	6				89	3	-	215-30543	215-30030	Support, Fus. Pylon MFS FWD	2	3 depot	4	20 - 1CT - When disassembled
4-2	060	9				89	3	-	215-30544	215-30030	Support Fus. Pylon MFS Aft	2	3	4	20 1 CT - When disassembled
4-2	101	7				81	3	-	215-80093	215-80023	Support Assy. Wing Fold Actuator Outer Wing Sect.	2	3 phase	3	Chamfer before sealing - Stress analysis required.
4-4	014	73				95	10	-	215-24021		Beam Assy. Axle NLG	1	1	2/3/4	Corrosion preventative - at each inspection interval in suspect areas.
4-4	048					85	3	-	215-44454	215-44020	Pin Bumper Link Attach Arresting Gear	2	3 phase	2	-
4-4	017	27				80	3	-	215-24488	215-24070	Bolt Shoulder Drag Brace Down Lock NLG	2	3 phase	2	Vac. cad. plate radius and 365-1CT
4-5	021		3-2	4-19	4	85	5	-	215-70385	215-70350	Support Assy. Spoiler Ctr. Wing Sect. T.E. Inbd.	2	1 phase	1/4	Chamfer before sealing.1.Stress analysis required. 2. Seal per Spec. CVA6-177(12)
4-5	011					84	5	-	215-88109	215-88030	Bellcrank Assy. Aileron Control Outer	2	3 phase	1/4	Chamfer before sealing.1. Stress analysis required. 2. Seal per Spec. CVA6-177(12)
4-5 4-2	010 100					82	5	-	215-80320	215-80071 215-80054	Hinge Assy. Aileron Ctr.	2	3 phase	3	Chamfer before sealing. 1. Stress analysis required. 2. Seal per Spec. CVA6-177(12)
4-5	055					82	5	yes	215-70194	215-70192	Outbd Flap Slot Doors	1	1 phase	1	Chamfer before sealing - T6 only. 1. Stress analysis req'd. 2. Seal per spec. CVA6-177 (12)
4-5	021		3-2	4-19	4	81	5	-	215-70360	215-70350	Support Assy. Spoiler Outbd. Ctr. Wing Sect.T.E.	2	1 phase	1/4	Chamfer before sealing.1. Stress analysis req'd. 2. Seal per Spec. CVA6-177(12)
4-5	051/ 053					66	5	yes	215-80200		Flap Assy. Wing Landing L.E. Outbd.	4	1 depot	5	No change
			3-2	1-40	18	95	10	yes	215-24031		Housing Assy. Shock Strut Cyl. NLG	1	1 phase	2/3/4	Trunnion (1)&(2) Nameplate(3). 1.IVD+ 365 - 2CT + corr. prevent. if removed 3. Mil-S-8802 sealant under nameplate
4-2	078	22	3-2	6-124	79	94	10	yes	215-30402	215-30079 220-30025A 215-30025B	Bulkhead Sect., MLG Attach STA 490.5	1	1 phase	1/2/3	Fair water trap area, Mil-S-8802. Prone area - 215-30079
4-2	076	12& 13	3-2	6-14	1	92	10	yes	215-30401	215-30078 220-30024	Bulkhead Sect. Wing Attach STA 480	6	4 depot	4	IVD (A1)

(1) Criticality Rating (2) Failure Occurrence

CRITICALITY RATING, TA-7C

IPB NAVAIR 01-45AAF VOL.	FIG.	IND.	SRM NAVAIR 01-45AAA VOL.	FIG.	IND.	SCC RATING	C/R (1)	F/O (2)	PART NO.	NEXT ASSY.	NOMENCLATURE	INSPECTION A	B	C	IMPROVEMENT METHOD AND NOTES
			3-2	4-2	102	90	10	-	215-70405	215-70057	Rib, Ctr. Wing Sect. Wing Attach	6	4 depot	3	NiCd plate bushings
			3-2	5-28	4	80	10	yes	CV15-160033	216-60200	Shaft, UHT	2	5 phase/depot	5	Add sealant to faying surface; MIL-S-8802
4-2	102	59	3-2	4-26	13	105	9	yes	215-80403	215-80057	Support Wing Fold Rib Outer Wing Sect.	1	1 phase	3	Chamfer before sealing. 1. Stress analysis req'd. 2. Seal per Spec. CVA6-177(12). Prone area 215-80057
			3-2	5-28	70	80	9	-	215-60210	215-60200	Housing, Bearing Horizontal Stab.	10	7 depot	4	Seal faying surface - MIL-S-8802 per CVA6-177(1)
			3-2	4-2	106	85	7	-	215-70447	215-70039	Spar, CWS Inter No. 4, Inbd.	4	1 depot	5	Add polyurethane fuel tank coating in fuel tank area
			3-2	4-2	41	81	7	-	215-70446	215-70038	Spar CWS Inter No. 3, Outbd.	4	1 depot	5	Add polyurethane fuel tank coating in fuel tank area
			3-2	4-2	43	81	7	-	215-70448	215-70039	Spar CWS Inter No. 4, Outbd.	4	1 depot	5	Check for vac. cad + 365
			3-2	4-25	41	80	7	-	215-80404	215-80035	Spar, Outer Wing Sect. Front	2	3 depot	2/3	366-ICT add where accessible
			3-2	4-2	55	82	5	-	215-70468	215-70051	Rib, CWS STA Y97.2 STA Xw 122 to Xw 133	4	1 depot	5	Corrosion preventative in crevices
			3-2	4-2	3,9, 31	82	5	-	215-70410	215-70050	Extension Wing Fold Rib, CWS	4	1 depot	5	IVD (Al) plus 365-ICT - when disassembled
			3-2	4-32	21	87	3	-	215-70070	215-70069	Support Assy. Inbd. Wing Pylon Center Wing Sect.	2	1 depot	4	366 - ICT
			3-2	4-33	26	87	3	-	215-70071	215-70067	Support Assy. Ctr. Wing Pylon	6	1 depot	1/4	366 - ICT
			3-2	4-15	7	84	3		215-70101	215-70027	Rib Trailing Edge CWS STA 135	4	1 depot	2/5	Chamfer before sealing - stress analysis required
4-2	101	7				81	3	-	215-80093	215-80023	Support Assy. Wing Fold Actuator Outer Wing Sect.	2	3 phase	3	Chamfer before sealing - stress analysis required
			3-2 ,2 3-2	6-152 6-99	122 54	88	10	yes	220-30081	220-30057 218-30057	Catapult Longeron	3	1 phase	2/3	New shim and fastener system. Prone area - 218-30057
			3-2 2	4-5	151	80	7	yes	216-70418	215-70035	Spar, Center Wing Sect. Front Center	3	1 depot	3	20 - ICT
			3-2 2	6-151	30& 31	88	5	-	215-30482	220-30072	Splice Members Brake Flap Support MFS STA 372	3	1 phase	1/4/5	Apply sealant - install fasteners with MIL-S-8802 per CVA6-177(6)
			3-2,2 3-2	6-52 6-99	98-101 125-128	82	5	yes	215-30420	218-30057 220-30057	Catapult Longeron Splice	3	1 phase	1	Shim for fit - Prone Area - 218-30057
			3,2-2	6-66	45	80	3	-	215-20408	220-20300	Support Assy. Aircraft Ejection Seat-Cockpit	6	3 depot	1	Seal bushing per Spec. CVA6-177(12)
			3-2,2	6-26	39	102	1	-	215-20410	215-20030	Mounts, Fwd Looking Radar NFS	3	3 phase	1	Chamfer before sealing. 1. Stress analysis required. 2. Seal per Spec. CVA6-177(12)

(1) Criticality Rating (2) Failure Occurrence

STRESS CORROSION FAILURE PROBABILITY RATING, TA7C FIGURE 19

IPB NAVAIR 01-45AAF VOL.	FIG.	IND.	SRM NAVAIR 01-45AAA VOL.	FIG.	IND.	SCC RATING	C/R (1)	F/O (2)	PART NO.	NEXT ASSY.	NOMENCLATURE	INSPECTION A	B	C	IMPROVEMENT METHOD AND NOTES
4-2	096	13				95	9	-	215-40402	215-40023	Support Vert. Stab. AFS STA 653.6 Side	4	1 depot	5	Apply sealant when disassembled - 1. Install fasteners with MIL-S-8802 per CVA6-177(6). 2. Faying surface sealant MIL-S-8802 per CVA6-177(1)
4-2	112	27				92	3	-	215-70326	215-70056	Rib Assy. Flap Hinge Ctr Wing Sect. Outbd.	2	1 phase	1/4	366-ICT
4-2	112	1				92	3	-	215-70325	215-70055	Rib Assy. Flap Hinge Ctr Wing Sect. Inbd.	2	1 phase	1/4	366-ICT
4-2	060	6				89	3	-	215-30543	215-30030	Support, Fus. Pylon MFS, FWD	2	3 depot	4	20 ICT - When disassembled
4-2	060	9				89	3	-	215-30544	215-30030	Support, Fus. Pylon MFS Aft	2	3 depot	4	20 - ICT - When disassembled
4-2	069					85	10	-	215-30080	215-30068	Support, Drag Strut MLG MFS	1	1 phase	1/3	Check bushings grease flow
4-2	109	52				83	7	-	215-70098	215-70052	Rib, Center Wing Sect. STA Y61.2	4	1 depot	2/5	IVD (AI)
4-2	101	7				81	3	-	215-80093	215-80023	Support Assy. Wing Fold Actuator Outer Wing Sect.	2	3 phase	3	Chamfer before sealing - Stress analysis required
4-2	100	49& 58	3-2	4-25	82	80	7	-	215-80072	215-80053	Hinge Assy. Aileron Outer Wing T.E. Outbd.	2	3 phase	3	IVD(AI)
4-4	014	73				95	10	-	215-24021		Beam Assy. Axle NLG	1	1 phase	2/3/4	Corrosion preventative - at each inspection interval in suspect areas
4-4	048	8				85	3	-	215-44454	215-44020	Pin Bumper Link Attach Arresting Gear	2	3 phase	2	-
4-4	017	27				80	3		215-24488	215-24070	Bolt, Shoulder Drag Brace Down Lock NLG	2	3 phase	2	Vac. cad plate radius and 365 - ICT
4-5	021		3-2	4-19	8	86	5	-	215-70385	215-70350	Support Assy. Spoiler Hinge Ctr. Wing Sect. T.E. Inbd.	2	1 phase	1/4	Chamfer before sealing. 1. Stress analysis required.2. Seal per Spec. CVA6-177(12)
4-5	011					84	5	yes	215-88109	215-88030	Bellcrank Assy. Aileron Control Outer	2	3	1/4	Chamfer before sealing. 1.Stress analysis req'd. 2. Seal per Spec. CVA6-177(12)
4-5 4-2	010 100					82	5	-	215-80320	215-80071 215-80054	Hinge Assy. Aileron Center	2	3 phase	3	Chamfer before sealing.1. Stress analysis req'd. 2. Seal per Spec. CVA6-177(12)
4-5	055					82	5	yes	215-70194	215-70192	OutBd. Flap Slot Doors	1	1 phase	1	Chamfer before sealing - T6 only 1. Stress analysis req'd. 2. Seal per Spec. CVA6-177(12)
4-5	021		3-2	4-19	4	81	5	-	215-70360	215-70350	Support Assy. Spoiler Hinge Outbd. Ctr. Wing Sect. T.E.	2	1 phase	1/4	Chamfer before sealing. 1. Stress analysis req'd.2. Seal per Spec. CVA6-177(12)
4-5	051/ 053					66	5	yes	215-30200		Flap Assy. Wing Landing L.E. Outbd.	4	1 depot	5	No change
4-2	102	59	3-2	4-26	13	105	9	yes	215-80403	215-08857	Support Wing Fold Rib Outer Wing Sect.	1	1 phase	3	Chamfer before sealing.1.Stress analysis req'd. 2. Seal per CVA6-177(12)
			3-2	1-40	18	95	10	yes	215-24031		Housing Assy. Shock Strut Cyl. NLG	1	1 phase	2/3/4	Trunnion (1) & (2) Nameplate (3). 1. IVD + 365 -2CT + corr. prevent. if removed. 2. Corr. prevent. 3. Sealant under nameplate. Prone area 215-80057

(1) Criticality Rating (2) Failure Occurrence

STRESS CORROSION FAILURE PROBABILITY RATING, TA7C

IPB NAVAIR 01-45AAF VOL.	IPB FIG.	IPB IND.	SRM NAVAIR 01-45AAA VOL.	SRM FIG.	SRM IND.	SCC RATING	C/R (1)	F/O (2)	PART NO.	NEXT ASSY.	NOMENCLATURE	INSPECTION A	INSPECTION B	INSPECTION C	IMPROVEMENT METHOD AND NOTES
4-2	078	22	3-2	6-124	79	94	10	yes	215-30402	215-30079 220-30025A 215-30025B	Bulkhead Sect. MLG Attach STA 490.5	1	1	1/2/3	Fair water trap area, MIL-S-8802 Prone Area 215-30079
4-2	076	12& 13	3-2	6-14	1	92	10	yes	215-30401	215-30078 220-30024	Bulkhead Sect. Wing Attach STA 480	6	4 depot	4	IVD (AI)
			3-2	4-2	102	90	10	-	215-70405	215-70057	Rib, Ctr. Wing Sect. Wing Attach	6	4 depot	3	NiCd Plate bushings
			3-2	4-32	21	87	3	-	215-70070	215-70069	Support Assy. Inbd Wing Pylon Ctr. Wing Sect.	2	1 depot	4	366 - ICT
			3-2	4-33	26	87	3	-	215-70071	215-70067	Support Assy. Ctr. Wing Pylon	6	1	1/4	366 - ICT
			3-2	4-2	106	85	7	-	215-70447	215-70039	Spar, CWS Intermediate No. 4. Inbd.	4	1 depot	5	Add polyurethane fuel tank coating in fuel tank area.
			3-2	4-15	7	84	3	-	215-70101	215-70027	Rib, Trailing Edge Ctr. Wing Sect. STA 135	4	1 depot	2/5	Chamfer before sealing - Stress analysis required.
			3-2	4-2	55	82	5	-	215-70468	215-70051	Rib, CWS STA Y97.2 STA Xw122 to Xw133	4	1 depot	5	Corrosion preventative in crevices
			3-2	4-2	3,9,31	82	5	-	215-70410	215-70050	Extension Wing Fold Rib, CWS	4	1 depot	5	IVD(AI) + 365 - ICT - When disassembled
			3-2	4-2	41	81	7	-	215-70446	215-70038	Spar CWS Intermed. No. 4 Outbd	4	1	5	Add polyurethane fuel tank coating in fuel tank area
			3-2	4-25	41	80	7	-	215-80404	215-80035	Spar, Outer Wing Sect. Front	2	3	2/3	366 - ICT - Add where accessible
			3-2	5-28	4	80	10	yes	CV15-160033	216-60200	Shaft, UHT	2	5 phase/depot	5	Add sealant faying surface; MIL-S-8802
			3-2	5-28	70	80	9	-	215-60210	215-60200	Housing Bearing Horizontal Stab.	10	7 depot	4	Seal faying surface - MIl-S-8802 per CVA6-177(1)
			3-2, 2	6-26	39	102	1	-	215-20410	215-20030	Mounts, Fwd Looking Radar, NFS	3	3 phase	1	Chamfer before sealing.1. Stress analysis req'd.2. Seal per Spec. CVA6-177(12)
			3-2, 2	6-66	45	80	3	-	215-20408	220-20300	Support Assy. Aircraft Ejection Seat-Cockpit	6	3 depot	1	Seal bushings per Spec. CVA6-177(12)
			3-2, 2	4-5	151	80	7	yes	215-70418	215-70035	Spar Ctr. Wing Sect. Front Center	3 depot	1	5	20 - 1 CT
			3-2 2 3-2	6-52 6-99	98- 101 125- 128	82	5	yes	215-30420	218-30057 220-30057	Catapult Longeron Splice	3	1 phase	1	Shim for fit. Prone area 218-30057
			3-2 2 3-2	6-152 6-99	122 54	88	10	yes	220-30081	220-30057 218-30057	Catapult Longeron	3	1 phase	2/3	New shim & fastener system. Prone Area 218-30057

(1) Criticality Rating (2) Failure Occurrence

8.0 ADDENDUM

PREPARED
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DISTRIBUTION 4

CODE IDENT NO. 80378

VOUGHT CORPORATION
systems division
Post Office Box 5907 • Dallas, Texas 75222
ENGINEERING DEPARTMENT SPECIFICATION

CONTR NO. ______

NO. CVA TB-21V
PAGE 1 OF 44
DATE 6-28-77

OFFICIAL ENGINEERING RELEASE

TECHNICAL BULLETIN

FINISH CODE NUMBERS

APPLICABILITY: This technical bulletin is applicable wherever CVA TB-21 is called out.

CHANGE SUMMARY: (1) Incorporated Amendment No. 2 & extensive changes throughout text.

INCORPORATION DATE: On or before 7-28-77

The symbol Ø has been omitted due to extensive changes.

APPROVALS

PREPARING ACTIVITY	PROJ. ENGR.	TECH DATA SERVICES	COGNIZANT ACTIVITIES		
[signature]	[signature]	[signature]			
DATE	DATE 6-28-77	DATE 6-21-77	DATE	DATE	DATE

1. SCOPE - This technical bulletin contains an alphabetical and numerical listing of the finish code numbers used on Vought drawings to indicate processes and materials required for protection of parts and assemblies of Vought products. This bulletin supersedes drawing CVS-22600.

1.1 Table I, Disposition of Code Numbers changed or eliminated.

1.2 Table II, Alphabetical Index

1.3 Table III, Numerical Index

1.4 Table IV, Camouflage Colors; list of Standard Aircraft

1.5 Table V, Glossy Colors; list of Standard Aircraft

2. RULES FOR THE USE OF FINISH CODE NUMBERS

2.1 TB-21 code numbers are used on drawings to designate only those finish processes and materials covered by the scope of MIL-F-7179.

2.2 The finish for an item is denoted in the drawing's Parts List by a number prefixed by "F". EXAMPLE: "FXXX." The "F" number identifies the required finish using TB-21 finish codes. Definition of the "F" number is shown in the Parts List/drawing "FINISH NOTES" or "FINISH" block. EXAMPLE: F693 71/365-1CT/366-2CT

"F" number TB-21 code(s) finish requirement

2.3 The TB-21 code number and the abbreviation CT signify the finish number described herein and the number of coats to be applied. For example: 20-1CT/21-2CT means "One coat of finish material number 20 followed by two coats of finish material number 21".

2.4 When necessary to call out finish processes on the FIELD of a drawing or in the GENERAL NOTES, they shall be designated by the PROCESS SPECIFICATION NUMBER. No reference shall be made anywhere on the drawing to the materials involved, provided the referenced process specification contains the required material callout.

2.5 The abbreviation "Spec" shall precede all callouts of specifications except when the specification is called out in a column headed SPECIFICATION. In addition, all Vought specifications shall have the abbreviation CVA included except for new specifications. For new material specifications the "CVA" is replaced by "207-", and for new process specifications "208-". When applicable, the grade, type, or class shall be indicated. Example: Spec CVA X-XXX, Type I, Spec 207-X-XXX, Type I.

3. BASIC CHANGES IN (d) REVISION

3.1 This revision employs all of the FINISH code numbers of the old issue without change, except as follows:

a. Where finish processes are called out in the FINISH COLUMN by a combination of a number and a suffix letter, a new code using just a number without the letter has been assigned. For example:

OLD CODE	NEW CODE
5I	301
5IIA	302
5IIB	303

b. Where finish process specifications are called out directly on the FIELD or GENERAL NOTES of a drawing by specification number, there is no need for assigning finish code numbers, so codes for this type of specification have been omitted from this revision. Specification CVA 9-92 falls within this group.

c. Where the old code covers a process or material not classifiable as a FINISH process within the scope of MIL-F-7179, such as old codes have been eleminated in accordance with the rules for the use of finish code numbers, outlined in Section 2. Specifications CVA 13-180 and CVA 13-225 fall within this group.

3.2 For convenient reference, all code numbers changed or eliminated from TB-21 pursuant to paragraph 3.1 are listed in Table I.

3.3 Since the system for numbering VSD Process and Material Specifications has also been revised this date, all references to those specifications within the body of TB-21 have been changed to the new specification numbers.

3.4 Under the new specification numbering system, all VSD Process and Material Specifications will always be preceded by a prefix classification number and a dash. Example: Old Specification CVA 92 is now shown as Specification CVA 9-92.

3.5 Under this revision of TB-21, code numbers are never preceded or followed by any number or letter. Thus, in the future it should always be apparent whether a specification or process is being referenced by specification number or code number.

3.6 Table III lists the FINISH CODE NUMBERS.

4. REVISION (g)

a. Deletes use of Delco 734D from code 311.

b. Adds new codes 347, 348, and 349 for epoxy enamels.

---

c. Incorporates treatment for cadmium plate in code 20.

5. REVISION (h) - Changes of revision (h) are of form only, not of substance.

6. REVISION (j) - Revision to code 71, adds codes 350 through 358 per amendments.

7. REVISION (k)

a. Adds reference to new 207- and 208- specification number prefixes.

b. Adds alphabetical listing Table II

c. Revises Codes as follows:

1. Up-dates code #17 to be in accord with Specification CVA 9-17.

2. Adds reference to MIL-M-45202 in Code Nos. 70 and 72.

3. Deletes Code #126 and #51.

4. Adds reference to MIL-V-173 to Code #144.

5. Deletes Code #173 and adds * (See Table I).

6. Deletes Code #321, 322, and 323.

7. Deletes lacquer application to Code #326.

8. Adds new Code Nos. 359 thru 380 by incorporating Amendment No. 6.

d. Revises color code numbers to comply with ANA Bulletin No. 157d and ANA Bulletin No. 166d. (Tables IV and V).

8. REVISION (m)

a. Revises Code #6 to comply with CVA 1-6 (Tables II and III).

b. Changes Code Nos. 21, 22, 23, 27, 37, 42, 46, 277, 338, 339, 355, and 376 ANA Color Nos. to Fed. Std. No. 595 Nos. as follows:

TABLES II AND III

Old ANA Color No.	New Fed. Std. 595 Color No.
509	11136
607	35042
612	34092
613	34087
623	15042

c. Revises Tables IV and V to comply with ANA Bulletins Nos. 157e and 166e.

9. REVISION (n)

a. Incorporates Amendment No. 3.

b. Adds new Code Nos. 386, 387, 388.

10. REVISION (p)

a. Incorporates outstanding amendments.

b. Adds new Code Nos. 389 and 390.

c. Deleted Lithoform #2 from general treatment of cadmium plated surfaces

d. Eliminated Codes 347, 348 and 349.

e. Revised finish codes 17(1) and 17(5).

11. REVISION (q)

a. Incorporates outstanding amendment.

b. Revised surface preparation for aluminum and Fabrilite.

c. Revised touch-up treatment for aluminum alloy and magnesium.

d. Added touch-up treatment for titanium.

e. Revised explanation of Codes 4, 17(1), 17(2), and 18.

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12. REVISION (r)

a. Incorporated Amendment No. 1.

b. Revised Finish Codes 366 and 367 to reflect U.S. Navy F-8 aircraft spares. This change corrected Amendment No. 2.

c. Included use of 207-9-414 polyurethane enamel in Tables II and III.

13. REVISION (s)

a. Incorporated Amendment No. 1.

b. Revised rules for use of finish codes (paragraphs 2.1, 2.2, 2.3 and 2.4).

14. REVISION (T)

a. Incorporated outstanding amendment.

b. Revised material and application callout.

c. Added new Code Numbers 399 thru 409.

d. Deleted obsolete code numbers.

15. REVISION (U)

a. Revised Code Numbers 70, 72, 76, 77, 317, 318, and 370.

b. Added new Code Numbers 410(1) thru 424.

16. REVISION (V)

a. Incorporated outstanding amendment.

b. Clarified section 2.

c. Revised Code 391 to replace Code 340.

d. Deleted CVA 9-406 and CVA 9-8.

e. Updated Tables throughout text.

TABLE I

DISPOSITION OF CODE NUMBERS CHANGED OR ELIMINATED FROM TB-21

OLD CVA CODE NO.	NEW CODE NO. OR DISPOSITION	OLD CVA CODE NO.	NEW CODE NO. OR DISPOSITION
5I	300	99II	*
5IIA	301	99III	*
5IIB	302	99IV	*
8I	303	109	*
8II	304	113	*
13I	305	120	*
13II	306	129	**
13III	307	132	*
14	2	133	*
32	308	134	*
32I	309	137	*
36I	310	143	*
36II	311	148	*
41I	312	151	*
41II	313	155I	320
51	365	170	*
55III	314	171	*
61	373	172	*
62	372	173	*
63	371	174	*
64#	365	176	*
65	367	177	*
78	2	178	*
79	2	180	*
80	375	201	*
82#	366	203	*
84I	315	209	*
84II	316	220	*
87I	317	225	*
87II	318	247I	321
87III	319	247II	322
89	*	247III	323
92E	**	253	*
92F	**	261	*
92P	**	267I	324
92R	**	269	402
92S	**	270	*
		280	*
92T	**	281	*
97-XXXXXX	**		
99I	*		

TABLE I (Cont)

OLD CVA CODE NO.	NEW CVA CODE NO. OR DISPOSITION	OLD CVA CODE NO.	NEW CODE NO. OR DISPOSITION
317	318		
324	288		
325	374		
327	328		
331	***		
332	***		
335	378		
338	*		
340	391		
341	385		
343	***		
347	377		
348	371		
349	376		
350	365		
351	366		
353	386		
354	373		
355	376		
357	*		
368	***		

* These code numbers have been eliminated per section 3.1.(c).

** These code numbers have been eliminated per section 3.1.(b).

*** Referenced specifications cancelled.

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ENGINEERING DEPARTMENT TECHNICAL BULLETIN

TABLE II

ALPHABETICAL LISTING - FINISH CODES

MATERIAL	MATERIAL SPEC	PROCESS SPEC	COLOR	ANA/F.S. 595 NO.	CODE. NO.
ENAMELS					
Acrylic Mod.	MIL-L-81352	CVA 9-6	Insignia White	17875	336
Alkyd Camouflage	TT-E-527	CVA 9-27	Non Spec Sea Blue	35042	42
			Black	37038	47
			Light Gull Gray	36440	52
			Light Gray	36440	43
Alkyd, Gloss	TT-E-489 Class A	CVA 9-27	Aircraft Gray	16473	49
			Sea Blue	15042	27
			Insignia Blue	15044	44
			Insignia Red	11136	45
			Insignia White	17875	46
			International Orange	12197	342
			Black	17038	48
	TT-E-489 Class B	CVA 9-27	Aircraft Gray	16473	73
Alkyd, Light Gray	MIL-E-15090 Type II,Cl 2	CVA 9-27	Semi-gloss Gloss		76
	MIL-E-15090 Type II,Cl 1				77

TABLE II (Cont)

MATERIAL	MATERIAL SPEC	PROCESS SPEC	COLOR	ANA/F.S. 595 NO.	CODE. NO.
			Camouflage Black	37038	398
			Camouflage Blue, Insignia	35044	403
			Camouflage Gray	36622	397
			Camouflage Dark Gull Gray	36231	407
			Camouflage Green	34102	395
Polyurethane	207-9-414	208-9-19	Camouflage Green, Dark	34079	396
			Camouflage Red	31136	400
			Camouflage Tan	30219	394
			Camouflage White	37875	402
			Camouflage Yellow	33538	401
			Gloss Black, Jet	17038	404
			Gloss, Blue, Insignia	15044	405
			Gloss, Insignia White	17875	392
			Gloss, Light Gull Gray	16440	393
			Gloss, Orange Yellow	13538	408
			Gloss, Red	11136	406
			Camouflage Black	37038	373
			Camouflage Bright Red	31136	374
			Camouflage Dark Gull Gray	36231	372
			Camouflage Light Gull Gray	36440	367
			Camouflage Orange Yellow	33538	375
Epoxy Polyamide	MIL-C-22750 (MOD)	MIL-C-22751	Gloss Orange Yellow	13538	371
			Gloss White	17875	366
			Modified Gloss Aircraft Gray	16473	377
			Modified Gloss Insignia Red	11136	376
			Modified Gloss International Orange	12197	378
			Modified Gloss Black	17038	386
Silicone	L6X 238		Aluminized	17178	145
Wrinkle-Finish	MIL-E-5558	MIL-E-7851	Gloss Black	17038	35
High Reflecting	207-9-411	208-9-57	White		379
			Black		380

TABLE II (Cont)

MATERIAL LACQUERS	MATERIAL SPEC	PROCESS SPEC	COLOR	ANA/F.S. 595 NO.	CODE. NO.
Acid Resistant	TT-L-54		Black		94
Acrylic Nitrocellulose Camouflage	MIL-L-19538	CVA 9-267	Dark Green	34079	381
			Tan	30219	382
			Green	34102	383
			Gray	36622	384
			Black	37038	385
			Light Gull Gray	36440	346
			Dark Gull Gray	36231	360
			Light Blue	35526	361
			Bright Red	31136	362
			Insignia White	37875	363
Acrylic Nitrocellulose Gloss	MIL-L-19537	CVA 9-267	Black	17038	288
			Insignia Red	11136	277
			Insignia White	17875	267
			Orange Yellow	13538	268
			Aluminized	17178	358
			Black	37038	30
			Bright Red	31136	29
Cellulose Nitrate Camouflage	TT-L-20	CVA 9-21	Dark Gull Gray	36231	33
			Light Gull Gray	36440	54
			Medium Green	34092	37
			Non-Spec Sea Blue	35042	22
			Olive Drab	34087	339
			Aircraft Gray	16473	75
			Black	17038	26
			Sea Blue	15042	21
Cellulose Nitrate Gloss	TT-L-22	CVA 9-21	Insignia Red	11136	23
			Insignia White	17875	28
			Instrument Black	27038	31
			International Orange	12197	334
			Orange Yellow	13538	24
			Aluminized	17178	25
			Insignia White (1Pt)	17875	344
Textured		CVA 9-10	Aircraft Gray (3Pt)	16473	
			Insignia White (1Pt)	17875	345
			Orange Yellow (3Pt)	13538	

TABLE II (Cont)

FINISH	CODE NO.
MISCELLANEOUS COATINGS	
Antigalling Compound, molybdenum disulfide applied per Specification CVA 10-87	
(Refer to Code Number 318).	317
Type II, Bonded (Cancelled in CVA 10-87. Use 207-10-408 per 208-10-10)	318
Type III, Rubbed	319
Cadmium, vacuum deposited, applied per Specification MIL-C-6837 Type II, Class 2	422
Chemical Finish, black, applied to copper alloys per Specification MIL-F-495	417
Corrosion Preventive, MIL-C-16173 Grade, I, applied per Specification CVA 9-93.	
To interior of closed tubular members	3
All other applications	93
Corrosion preventive, temporary, applied per Specification CVA 9-96	96
Dye, Black, applied per Specification CVA 13-14	387
Dye, Gold, applied per Specification CVA 13-14	411
Dye, Red, applied per Specification CVA 13-14	388
Flock Finish, glare reducing, applied per Specification CVA 9-56	56
Fungus-resistant coating, MIL-V-173 Type I applied per Specification CVA 7-144	144
Fuel-resistant coating, MIL-S-4383, applied per Specification CVA 6-177(13).	
Brush or spray	329
Fill and drain	330
Hard surface coating, applied per Specification CVA 13-119	420

TABLE II (Cont)

FINISH		CODE NO.
Lubricant, air-drying, solid film, 207-10-408, Type I, applied per Specification 208-10-10 Type I		424
Metal Spray, aluminum, applied per Specification CVA 13-9 and Specification MIL-M-6874		9
Nickel cadmium diffused coating, applied per AMS 2416		419
Nickel coating, electroless, applied per Specification 208-5-20		423
Polyurethane coating, 207-9-427, black, applied per Specification 208-9-80 for rain erosion resistance		399
Polyurethane coating, 207-9-427, white, applied per Specification 208-9-80 for rain erosion resistance		409
Polyurethane coating, 207-9-427, white, applied per Specification 208-9-71		391
Protection of high strength steels, applied per Specification CVA 9-164		164
Protection of Metalite edges per Specification CVA 8-39.		39
Protection of exterior surfaces during assembly		
	Aluminum surfaces	310
	Magnesium surfaces	311
Protection of non-structural tubing, applied per Specification 208-9-54		410(1) thru 410(24)
Protection of wood surfaces		326
Rain-erosion resistant coating applied per Specification CVA 9-41		
	Type I, non-metallic surfaces	312
	Type II, metallic surfaces	313
Resin coating, Spec MIL-R-3043, applied per Specification CVA 9-138		138

TABLE II (Cont)

FINISH		CODE NO.
Sanding sealer, 300B, applied to exterior surfaces and sanded smooth per Specification 208-9-37		421
Teflon enamel applied per Specification CVA 9-67		67
Varnish, Spec MIL-V-173, applied per Specification CVA 9-1		328
PLATING		
TYPE	PROCESS	
Cadmium	CVA 5-2	2
Chromium	CVA 5-5 Type I (flash)	300
Chromium	CVA 5-5 Type IIA (Plated to dimension)	301
Chromium	CVA 5-5 Type IIB (ground to dimension)	302
Copper	CVA 5-13 Type I (flash)	305
Copper	CVA 5-13 Type II	306
Copper	CVA 5-13 Type III	307
Gold	MIL-G-45204	414
Nickel	CVA 5-55 Type I	359
Nickel	CVA 5-55 Type II	416
Nickel	CVA 5-55 Type III	314
Rhodium	208-5-17	415
Silver	CVA 5-8 Type I (flash)	303
Silver	CVA 5-8 Type II	304
Tin	CVA 5-74 Type I	333
Zinc	QQ-Z-325 Type II, Class 2	418

TABLE II (Cont)

PLATING (Cont'd)	FINISH		CODE NO.
Plating, cadmium, apply 0.3 mil low embrittling cadmium to meet the requirements of QQ-P-416 Class 2 Type II per 208-5-15 Type II for touchup.			389
Plating, cadmium, stripping of, per Specification CVA 5-259, Method A			259
Plating, preparation of surfaces for			
	MATERIAL	PROCESS	
	Aluminum Alloy	CVA 5-155 Type I	337
	Aluminum Alloy	CVA 5-155 Type II	320
	Stainless Steel	CVA 5-149	149

TABLE II (Cont)

MATERIAL	MATERIAL SPEC	PROCESS SPEC	COLOR	CODE NO.
PRIMERS				
Lacquer	MIL-P-7962	CVA 9-266	Yellow	266
Polyamide Epoxy	MIL-P-23377	MIL-C-22751		365
Wash	MIL-C-8514	MIL-C-8507 MIL-F-18264		68
Zinc Chromate		MIL-P-6808	Yellow (Y)	20
		MIL-P-6808 (Spray)	Interior Green Tinted (T) 34151	308
		MIL-P-6808 (Spray or Fill and Drain)	Interior Green Tinted (T) 34151	309
	MIL-P-8585	CVA 9-53	Yellow (Y)	369
Zinc Chromate Dip		MIL-P-6808 (Fill and Drain)	Yellow (Y)	364

TABLE II (Cont)

SURFACE TREATMENT	CODE NO.
ALUMINUM	
Anodize, hard, per Specification CVA 2-186, Type III	425
Anodize, chromic acid per Specification CVA 9-4; or Alodine per Specification 208-9-64	4
Anodize, chromic acid, per Specification CVA 9-4, Type A	19
Anodize, chromic acid, per Specification CVA 9-4, Type B	390
Anodize, hard, per Specification CVA 2-186, Type I	412
Anodize, hard, per Specification CVA 2-186, Type II	413
Anodize, sulfuric acid per Specification CVA 9-14	71
Anodize, sulfuric acid treatment in preparation for dyeing per Specification CVA 13-14	352
Alodine per Specification 208-9-64	18
Chromic acid treatment per Specification CVA 9-12	12
FABRILITE	
Blast clean per Specification CVA 9-131	370
Surface preparation, for finishing, per Specification CVA 9-131	131
MAGNESIUM	
Anodic treatment, low voltage per Specification MIL-M-45202, Type I Class C	70
Anodic treatment, high voltage per Specification MIL-M-45202 Type II Class D	72
Dichromate treatment per MIL-M-3171 Type III	15
Chrome Pickle treatment per MIL-M-3171 Type I	16
Sealed Chrome Pickle treatment per MIL-M-3171 Type II	40
HAE pretreatment coating per MIL-C-13335(ORD) Class II	69
STEEL	
Blast clean per Specification CVA 13-1	1
Hot linseed oil (TT-L-190) coating of tubing per MIL-F-7179	356
Phosphate coating, oil absorptive, per Specification CVA 9-84 Type I	315
Phosphate coating, paint base, per Specification CVA 9-84 Type II	316
Treat corrosion-resisting steel per Specification CVA 1-6 employing one of the following processes as required for the individual part:	
Dry blast	6(1)
Vapor blast	6(2)
Passivation - nitric-hydrofluoric	6(3)
Passivation - sodium dichromate nitric acid	6(4)
Polishing	6(5)

AD-A045 489 VOUGHT CORP DALLAS TEX F/G 11/6
STUDY TO IDENTIFY STRESS CORROSION PRONE PARTS ON THE TA-7C AIR--ETC(U)
OCT 77 O H COOK N62269-76-C-0353
UNCLASSIFIED 2-53400/7R-3428 NL

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TABLE II (Cont)

SURFACE TREATMENT	CODE NO.
TITANIUM	
Treat per Specification CVA 4-165	165
GENERAL	
Touch-up treatment per Specification CVA 9-17	

METAL	TREATMENT*	CODE NO. BRUSH	CODE NO. IMMERSION
Aluminum Alloy	Chemical Conversion Coating	17(1)	17(1)
Titanium	Chromate Chemical Conversion Coating	17(1)	
Magnesium	Chromate Chemical Conversion Treatment	17(2)	17(2)
Corrosion and Heat Resisting Alloys	Metalprep #10	17(3)	
	Sand Blast, Shot Peen, or lightly Sand	17(4)	
Cadmium Plated Surfaces	Chromate Chemical Conversion Treatment	17(5)	17(5)
Carbon and Low Alloy Steels	Granodine #50	17(6)	
	Zinc Phosphate CVA 9-84 Type II		17(6)
	Sand Blast, Shot Peen, or lightly Sand	17(7)	

* See Specification CVA 9-17 for applications and restrictions

TABLE III

NUMERICAL LISTING - FINISH CODE NUMBERS

FINISH CODE NO. NEW	OLD	EXPLANATION
1	1	Blast clean per Specification CVA 13-1.
2	2	Cadmium plate per Specification CVA 5-2.
3	3	Flush the interior of closed tubular members of partially closed recesses per Specification CVA 9-93.
4	4	Treat aluminum and aluminum alloys by anodizing, Specification CVA 9-4, or apply Alodine treatment per Specification 208-9-64.
6	6	Treat corrosion-resisting steel per Specification CVA 1-6 employing one of the following processes as required for the individual part:
6(1)	6	Dry blast
6(2)	6	Vapor blast
6(3)	6	Passivation - nitric-hydrofluoric acid
6(4)	6	Passivation - sodium dichromate nitric acid
6(5)	6	Polishing
9	9	Aluminum metal spray per Specification CVA 13-9 and Specification MIL-M-6874.
12	12	Apply chromic acid treatment per Specification CVA 9-12.
14	14	Cancelled, when specified on drawings substitute Code 2.
15	15	Clean magnesium alloy parts per Specification CVA 9-291 and apply dichromate surface treatment per Specification MIL-M-3171, Type III.
16	16	Clean magnesium alloy parts per Specification CVA 9-291 and apply chrome pickle surface treatment per Specification MIL-M-3171, Type I.
17(1)	17	Apply chemical conversion coating to aluminum or titanium alloys per Specitication 9-17.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
17(2)	17	Apply chemical conversion coating to magnesium alloys per Specification CVA 9-17.
17(3)	17	Apply Metalprep #10 to corrosion and heat resisting alloys per Specification CVA 9-17.
17(4)	17	Sand blast, shot peen, and lightly sand corrosion and heat resisting alloys per Specification CVA 9-17.
17(5)	17	Apply chromate chemical conversion treatment to cadmium plated surfaces per Specification CVA 9-17, except no treatment is required for Cadmium post treated per CVA 5-2.
17(6)	17	Apply Granodine #50 (brush) or zinc phosphate treatment CVA 9-84 Type II (immersion) to carbon and low alloy steels per Specification CVA 9-17.
17(7)	17	Sand blast, shot peen, or lightly sand carbon and low alloy steels per Specification CVA 9-17.
18	18	Apply Alodine treatment to aluminum and aluminum alloys per Specification 208-9-64.
19	19	Anodize aluminum and aluminum alloys per Specification CVA 9-4, Type A. Parts which are to be bonded following anodizing shall not be sealed.
20	20	Apply per Specification MIL-P-6808 the indicated number of coats of yellow zinc chromate primer, MIL-P-8585, color Y. When applying Specification MIL-P-8585 zinc chromate primer by the flow-coating process, Specification CVA 9-15 shall be used. Specification CVA 9-15 is for "VSD Shop Use Only". If the part has been cadmium plated, treat the cadmium plate per Specification CVA 9-17(5) prior to priming.
21	21	Apply per Specification CVA 9-21 the indicated number of coats of glossy sea blue lacquer, Specification TT-L-32, color 15042.
22	22	Apply per Specification CVA 9-21 the indicated number of coats of nonspecular sea blue lacquer, Specification TT-L-20, color 35042.
23	23	Apply per Specification CVA 9-21 the indicated number of coats of insignia red lacquer, Specification TT-L-32, color 11136.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
24	24	Apply per Specification CVA 9-21 the indicated number of coats of orange-yellow lacquer, Specification TT-L-32, color 13538.
25	25	Apply per Specification CVA 9-21 the indicated number of coats of aluminized lacque, Specification TT-L-32, color 17178.
26	26	Apply per Specification CVA 9-21 the indicated number of coats of gloss black lacquer, Specification TT-L-32 color 17038.
27	27	Apply per Specification CVA 9-27 the indicated number of coats of gloss sea blue enamel, Specification TT-E-489, Class A, color 15042.
28	28	Apply per Specification CVA 9-21 the indicated number of coats of insignia white lacquer, Specification TT-L-32, color 17875.
29	29	Apply per Specification CVA 9-21 the indicated number of coats of camouflage bright red lacquer, Specification TT-L-20, color 31136.
30	30	Apply per Specification CVA 9-21 the indicated number of coats of camouflage black lacquer, Specification TT-L-20, color 37038.
31	31	Apply per Specification CVA 9-21 the indicated number of coats of instrument black lacquer, Specification TT-L-32, color 27038.
33	33	Apply per Specification CVA 9-21 the indicated number of coats of camouflage dark gull gray lacquer, Specification TT-L-20, color 36231.
34	34	Apply the indicated number of coats of lacquer per Specification CVA 9-34 to provide resistance to nonflammable hydraulic fluid.
35	35	Apply per Specification MIL-E-7851 the indicated number of coats of black wrinkle enamel, Specification MIL-E-5558, Type II, color 17038.
37	37	Apply per Specification CVA 9-21, the indicated number of coats of camouflage medium green lacquer, Specification TT-L-20, color 34092.
39	39	Finish wood surfaces per Specification CVA 8-39.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
40	40	Clean magnesium alloy parts per Specification CVA 9-291 and apply sealed chrome pickle surface treatment per Specification MIL-M-3171, Type II.
42	42	Apply per Specification CVA 9-27 the indicated number of coats of nonspecular sea blue enamel, Specification TT-E-527, color 35042.
43	43	Apply per Specification CVA 9-27 the indicated number of coats of camouflage light gray enamel, Specification TT-E-527, color 36440.
44	44	Apply per Specification CVA 9-27 the indicated number of coats of gloss insignia blue enamel, Specification TT-E-489, Class A, color 15044.
45	45	Apply per Specification CVA 9-27 the indicated number of coats of gloss insignia red enamel, Specification TT-E-489, Class A, color 11136.
46	46	Apply per Specification CVA 9-27 the indicated number of coats of gloss insignia white enamel, Specification TT-E-489, Class A, color 17875.
47	47	Apply per Specification CVA 9-27 the indicated number of coats of camouflage black enamel, Specification TT-E-527, color 37038.
48	48	Apply per Specification CVA 9-27 the indicated number of coats of black enamel, Specification TT-E-489, Class A, color 17038.
49	49	Apply per Specification CVA 9-27 the indicated number of coats of aircraft gray enamel, Specification TT-E-489, Class A, color 16473.
51	51	Cancelled. When specified on drawings, substitute code 365.
52	52	Apply per Specification CVA 9-27 the indicated number of coats of camouflage light gull gray enamel, Specification TT-E-527, color 36440.
54	54	Apply per Specification CVA 9-21 the indicated number of coats of camouflage light gull grey lacquer, Specification TT-L-20, color 36440.
56	56	Apply glare reducing flock finish per Specification CVA 9-56.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
See Table I	61	Apply per Specification CVA 9-61 the indicated number of coats of nonspecular black epoxy enamel, Specification CVA 9-597, color 37038.
See Table I	62	Apply per Specification CVA 9-61 the indicated number of coats of dark gull gray epoxy enamel, Specification CVA 9-597, color 36231.
See Table I	63	Apply per Specification CVA 9-61 the indicated number of coats of orange-yellow epoxy enamel. Specification CVA 9-597, color 13538.
See Table I	64	Apply per Specification CVA 9-5 the indicated number of coats of strontium chromate primer, Specification CVA 9-598, color 34151.
See Table I	65	Apply per Specification CVA 9-61 the indicated number of coats of light gull gray camouflage epoxy enamel, Specification CVA 9-597, color 36440.
67	67	Apply per Specification CVA 9-67 the indicated number of coats of Teflon One-Coat Enamel.
68	68	Apply one coat of wash primer, Specification MIL-C-8514, per Specification MIL-C-8507, to surfaces prepared and tested per paragraphs 5.1.3 and 5.1.4 of Specification MIL-F-18264.
69	69	Apply per Specification MIL-C-13335(ORD) the indicated thickness of Class II pretreatment coating (HAE).
70	70	Clean per Specification CVA 9-291 Type II and apply low voltage anodic surface treatment to magnesium per Specification MIL-M-45202 Type I, Class C.
71	71	Apply sulfuric acid anodic treatment (0.0003" - 0.0005" thickness) to aluminum alloys for corrosion protection per Specification CVA 9-14.
72	72	Clean per Specification CVA 9-291 Type II and apply high voltage anodic surface treatment to magnesium bars, castings, and extrusions per Specification MIL-M-45202 Type II, Class D.
73	73	Apply and bake per Specification CVA 9-27 the indicated number of coats of aircraft gray enamel, Specification TT-E-489, Class B, color 16473.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
75	75	Apply per Specification CVA 9-21 the indicated number of coats of aircraft gray lacquer, Specification TT-L-32, color 16473.
76	76	Apply per Specification CVA 9-27 the indicated number of coats of semigloss light gray enamel, formula number 111, Specification MIL-E-15090, Type II, Class 2.
77	77	Apply per Specification CVA 9-27 the indicated number of coats of gloss light gray enamel, formula number 111, Specification MIL-E-15090, Type II, Class 1.
78	78	Cancelled, when specified on drawings substitute code 2.
79	79	Cancelled, when specified on drawings substitute code 2.
See Table I	80	Apply per Specification CVA 9-61 the indicated number of coats of camouflage orange-yellow epoxy enamel, Specification CVA 9-597, color 33538.
See Table I	82	Apply per Specification CVA 9-61 the indicated number of coats of gloss white epoxy enamel, Specification CVA 9-597, color 17875.
See Table I	89	Define surface roughness standards by Specification CVA 13-89.
See Table I	92E	Protect edges of removable panels with foil tape per Specification CVA 9-92.
See Table I	92F	Protect magnesium alloy surfaces from the possibility of corrosion due to the use of fasteners of materials other than 5056 or 6061 aluminum alloy by the use of 5052 aluminum alloy foil tape per Specification CVA 9-92.
See Table I	92P	Insulate dissimilar metal contact with additional coats of primer per Specification CVA 9-92.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
See Table I	92R	Protect the edges of fixed panels in which one or both are magnesium by rounding the outside edges to approximately 0.01" radius and filling the gaps per Specification CVA 9-92.
See Table I	92S	Seal magnesium-to-magnesium contacts or other contacts as specified using protective sealant per Specification CVA 9-92.
See Table I	92T	Insulate metal contacts with vinyl tape and, if required, additional coats of primer per Specification CVA 9-92.
93	93	Apply permanent hard film type rust preventive compound to springs, cables, recessed holes, and other areas as noted per Specification CVA 9-93.
94	94	Apply 2 coats of black acid-resisting lacquer, Specification TT-L-54 to the interior of the battery compartment and to surfaces subject to acid spillage or spray as noted.
96	96	Apply temporary rust preventive for protection during fabrication, storage, or shipping per Specification CVA 9-96.
See Table I	97-X.XXXX	Install heat barrier material in accordance with Specification CVA 9-97, using the number of plies as indicated by the first dash number of the code and the thickness of each ply in fractions of an inch as indicated by the second dash number.
See Table I	99I	Join rubber to other surfaces with oil resisting cement per Specification CVA 6-99, Type I.
See Table I	99II	Join rubber to other surfaces with gasoline and aromatic resistant cements per Specification CVA 6-99, Type II.
See Table I	99III	Join rubber to other surfaces with natural rubber cements per Specification CVA 6-99, Type III.
See Table I	99IV	Bond rubber to other surfaces employing heat and pressure to produce a high strength joint per Specification CVA 6-99, Type IV.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
See Table I	109	Apply abrasion protection per Specification CVA 7-109 to hose and tubing as required on installation.
See Table I	113	Apply fabric to metal or plywood surfaces per Specification CVA 8-113.
See Table I	120	Glue wood joints per Specification CVA 8-120.
#	126	Apply conductive coating as noted per Specification CVA 9-126.
#	128	Protect surfaces with plastic film during assembly or processing per Specification CVA 9-128.
See Table I	129	Apply aerodynamically smooth exterior finish per Specification CVA 9-129.
131	131	Finish the surfaces of Fabrilite per Specification CVA 9-131.
See Table I	132	Hot form magnesium alloy parts per Specification CVA 3-132.
See Table I	133	Apply pressure sensitive decalcomanias per Specification CVA 9-133.
See Table I	134	Form aluminum alloy parts per Specification CVA 2-134.
See Table I	137	Fabricate rubber parts by coating forms with latex per Specification CVA 6-137.
138	138	Apply and bake per Specification CVA 9-138 permanent resin coating, Specification MIL-R-3043.
See Table I	143	Post form phenolic sheet per Specification CVA 7-143.

No longer in use. Referenced specification is cancelled.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
144	144	Apply moisture and fungus resistant coating MIL-V-173 Type I to thermosetting plastic by vacuum impregnation per Specification CVA 7-144.
145	145	Apply to clean surfaces the indicated number of coats of heat-resistant paint, L6x238, Mico Aluminum, manufactured by Midland Industrial Finishes Company, Waukegan, Illinois. Bake at 375°F to 400°F for 1/2 hour.
See Table I	148	Vacuum impregnate thermosetting plastic fuel system components per Specification CVA 7-148.
149	-	Prepare stainless steel surfaces for electroplating per Specification CVA 5-149.
See Table I	151	Prepare fuel cell cavity, provide chafing protection, and inspect fuel cell per Specification CVA 6-151.
164	164	Prepare surfaces for painting and apply finish per Specification CVA 9-164.
165	165	Treat titanium and titanium alloy per Specification CVA 4-165.
See Table I	170	Assemble hydraulic units and install packings per Specification CVA 12-170.
See Table I	171	Flush and cap hose and tubing per Specification CVA 12-171.
See Table I	172	Assemble reusable hose and fittings per Specification CVA 12-172.
See Table I	173	Apply applicable thread or joint lubricant per Specification CVA 10-173.
See Table I	174	Install teleflex controls per Specification CVA 13-174.

No longer in use. Referenced specification is cancelled.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
See Table I	176	Assemble pneumatic units per Specification CVA 12-176.
See Table I	177	Apply sealant to joints or holes as noted per Specification CVA 6-177.
See Table I	178	Assemble hydraulic fittings, tubing, and hose per Specification CVA 12-178.
See Table	180	Safety wire, stake, seal, or otherwise secure parts as noted per Specification CVA 13-180.
See Table I	201	Install Hi-Shear rivets per Specification CVA 13-201.
See Table I	203	Apply water type decalcomanias per Specification CVA 9-203.
See Table I	209	Apply part numbers, inspection stamps, or other identification per Specification CVA 9-209.
See Table I	220	Install Huck Lock bolts per Specification CVA 13-220.
See Table I	225	Drill, form countersink or machine countersink rivet holes, install rivets, and inspect per Specification CVA 13-225.
See Table I	253	Prepare Metalite and Fabrilite cores per Specification CVA 8-253.
259	-	Strip cadmium plate from steel alloys per Specification CVA 5-259, Method A.
See Table I	261	Install fasteners through Metalite per Specification CVA 8-261.

* No longer in use. Referenced specification is cancelled.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
266	266	Apply per Specification CVA 9-266 the indicated number of coats of lacquer primer, Specification MIL-P-7962.
267	267	Apply per Specification CVA 9-267 the indicated number of coats of gloss insignia white acrylic nitrocellulose lacquer, Specification MIL-L-19537, color 17875.
268	268	Apply per Specification CVA 9-267 the indicated number of coats of gloss orange-yellow acrylic nitrocellulose lacquer Specification MIL-L-19537, color 13538.
269	269	Apply per Specification MIL-C-22751 the indicated number of coats of camouflage insignia white epoxy enamel, Specification MIL-C-22750 (MOD), color 37875.
See Table I	270	Prepare and bond Fabrilite components per Specification CVA 8-270.
277	277	Apply per Specification CVA 9-267 the indicated number of coats of gloss insignia red acrylic nitrocellulose lacquer, Specification MIL-L-19537, color 11136.
See Table I	280	Prepare and bond Metalite components per Specification CVA 8-280.
See Table I	281	Bond magnesium alloy with Redux adhesive per Specification CVA 8-281.
288	288	Apply per Specification CVA 9-267 the indicated number of coats of gloss black acrylic nitrocellulose lacquer, Specification MIL-L-19537, color 17038.
300	5I	Flash chromium plate designated areas per Specification CVA 5-5, Type I.
301	5IIA	Chromium plate designated area to dimension per Specification CVA 5-5, Type IIA.
302	5IIB	Chromium plate and grind designated areas per Specification CVA 5-5, Type IIB.

\# No longer in use. Referenced specification is cancelled.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
303	8I	Flash silver plate per Specification CVA 5-8, Type I.
304	8II	Silver plate per Specification CVA 5-8, Type II.
305	13I	Flash copper plate per Specification CVA 5-13, Type I.
306	13II	Copper plate (0.0006" - 0.0010" thickness) per Specification CVA 5-13, Type II.
307	13III	Copper plate (0.001" - 0.003" thickness) per Specification CVA 5-13, Type III.
308	32	Apply per Specification MIL-P-6808 using spray method only the indicated number of coats of interior green tinted primer, Specification MIL-P-8585, color T.
309	32I	Apply per Specification MIL-P-6808 using fill and drain method for enclosed surfaces, spray method for exposed surfaces, the indicated number of coats of interior green tinted primer, Specification MIL-P-8585, color T.
310	36I	Keep the exterior areas of aluminum alloy skin surfaces free from paint by removing paint with solvent immediately after dip priming, by removing overspray immediately after spraying, or by masking prior to painting. Protect surfaces in accordance with Quality Control instructions to prevent damage or abrasions.
311	36II	Keep the exterior areas of magnesium alloy skin surfaces free from paint by removing paint with solvent immediately after dip priming, by removing overspray immediately after spraying or by masking prior to painting.
312	41I	Apply rain erosion coating per Specification CVA 9-41, Type I for protection of nonmetallic aircraft parts.
313	41II	Apply rain erosion coating per Specification CVA 9-41, Type II for protection of metallic aircraft parts.

No longer in use. Referenced specification is cancelled.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
314	55III	Apply nickel plate (0.003" - 0.005" thickness) per Specification CVA 5-55, Type III.
315	84I	Apply oil absorptive phosphate coating per Specification CVA 9-84, Type I.
316	84II	Apply phosphate coating as a paint base per Specification CVA 9-84, Type II.
317	87I	Refer to Code No. 318.
318	87II	Apply molybdenum disulfide solid film lubricant Specification 207-10-408 Type II per Specification 208-10-10 Type II.
319	87III	Apply molybdenum disulfide antigalling compound per Specification CVA 10-87, Type III.
320	155II	Prepare aluminum alloys for electroplating per Specification CVA 5-155, Type II.
#321	247I	Protect faying surfaces by controlled time cycle dip priming and remove primer from exterior skin surface per Specification CVA 9-247, Type I.
#322	247II	Protect faying surfaces by controlled time cycle dip priming and retain primer on all surfaces per Specification CVA 9-247, Type II.
#323	247III	Protect faying surfaces by controlled time cycle dip priming and remove primer from all visible surfaces per Specification CVA 9-247, Type III.
324	267I	Refer to Code Number 288.
See Table I	325	Apply per Specification CVA 9-61 the indicated number of coats of camouflage bright red epoxy enamel, Specification CVA 9-597, color 31136.
326	-	Apply wood filler, Z-Spar (Natural) manufactured by Andrew Brown, or equivalent, to exterior surfaces and sand smooth.
327	-	Refer to Code Number 328.
328	-	Apply per Specification CVA 9-1 the indicated number of coats of varnish, Specification MIL-V-173.

No longer in use. Referenced specification is cancelled.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
329	-	Apply Specification MIL-S-4383 fuel resistant coating by brush or spray per Specification CVA 6-177(13).
330	-	Apply Specification MIL-S-4383 fuel resistant coating by fill and drain per Specification CVA 6-177(13).
#	331	Apply per Specification CVA 9-5 the indicated number of coats of heat-and-oil-resistant primer, Specification CVA 9-405, color 35352.
#	332	Apply per Specification CVA 9-2 the indicated number of coats of camouflage light gull gray acrylic enamel, Specification CVA 9-404, color 36440.
333	-	Apply tin plate (.0002" - .0004" thick) per Specification CVA 5-74, Type I.
334		Apply per Specification CVA 9-21 the indicated number of coats of gloss international orange lacquer, Specification TT-L-32, color 12197.
See Table I	335	Apply per Specification CVA 9-61 the indicated number of coats of gloss international orange epoxy enamel, Specification CVA 9-597, color 12197.
336	-	Apply the indicated number of coats of MIL-L-81352 acrylic lacquer, gloss white, color 17875 per Specification CVA 9-6.
337	155I	Prepare aluminum alloy surfaces for electroplating per Specification CVA 5-155, Type I.
See Table I	338	Apply per Specification MIL-C-22751 the indicated number of coats of camouflage olive drab epoxy enemel, Specification MIL-C-22750(MOD), color 34087.
339	-	Apply per Specification CVA 9-21 the indicated number of coats of camouflage olive drab lacquer, Specification TT-L-20, color 34087.
340	-	Refer to code No. 391.
341	-	Refer to Code No. 385.

No longer in use. Referenced specification is cancelled.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
342	-	Apply per Specification CVA 9-27 the indicated number of coats of gloss international orange enamel, Specification TT-E-489, Class A, color 12197.
*	343	Apply coal tar epoxy body coat per Specification CVA 9-11.
344	-	Apply per Specification CVA 9-10, FOR INTERIOR SHOP EQUIPMENT BOXES, one part of minor color 17875 to three parts of major color 16473.
345	-	Apply per Specification CVA 9-10, FOR FLIGHT LINE SUPPORT EQUIPMENT BOXES, one part of minor color 17875 to three parts of major color 13538.
346	-	Apply per Specification CVA 9-267 the indicated number of coats of light gull gray camouflage acrylic nitrocellulose lacquer, Specification MIL-L-19538, color 36440.
See Table I	347	Apply per Specification CVA 9-61 the indicated number of coats of gloss aircraft gray, color 16473, Specification CVA 9-597 epoxy enamel.
See Table I	348	Apply per Specification CVA 9-61 the indicated number of coats of gloss orange-yellow, color 13538, Specification CVA 9-597 epoxy enamel.
See Table I	349	Apply per Specification CVA 9-61 the indicated number of coats of gloss insignia red, color 11136, Specification CVA 9-597 epoxy enamel.
See Table I	350	Apply per Specification MIL-C-22751 the indicated number of coats of Specification MIL-P-23377 polyamide epoxy primer.
See Table I	351	Apply per Specification MIL-C-22751 the indicated number of coats of gloss white, color 17875, Specification MIL-C-22750(MOD) polyamide epoxy enamel.
352	-	Apply sulfuric acid anodic treatment (2,500 milligram per square foot) to aluminum in preparation for dyeing per Specification CVA 13-14.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
See Table I	353	Apply per Specification MIL-C-22751 the indicated number of coats of gloss black, color 17038, Specification MIL-C-22750(MOD) polyamide epoxy enamel.
See Table I	354	Apply per Specification MIL-C-22751 the indicated number of coats of black, color 37038, Specification MIL-C-22750(MOD) polyamide epoxy enamel.
See Table I	355	Apply per Specification MIL-C-22751 the indicated number of coats of red, color 11136, Specification MIL-C-22750(MOD) polyamide epoxy enamel.
356	-	Steel tubing to which thermal treatments exceeding 400°F are applied after assembly, shall be filled and drained or immersed to coat the interior areas with hot linseed oil (TT-L-190) per Specification MIL-F-7179, paragraph 5.10.2.
See Table I	357	Apply per Specification MIL-C-22751 the indicated number of coats of camouflage light blue epoxy enamel, Specification MIL-C-22750(MOD), color 35526.
358	-	Apply per Specification CVA 9-267 the indicated number of coats of gloss aluminized acrylic nitrocellulose lacquer, Specification MIL-L-19537, color 17178.
359	-	Apply flash nickel plate (0.0001" maximum thickness) per Specification CVA 5-55, Type I.
360	-	Apply per Specification CVA 9-267 the indicated number of coats of camouflage dark gull gray acrylic nitrocellulose lacquer, Specification MIL-L-19538, color 36231.
361	-	Apply per Specification CVA 9-267 the indicated number of coats of camouflage light blue acrylic nitrocellulose lacquer, Specification MIL-L-19538, color 35526.
362	-	Apply per Specification CVA 9-267 the indicated number of coats of camouflage bright red acrylic nitrocellulose lacquer, Specification MIL-L-19538, color 31136.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
363	-	Apply per Specification CVA 9-267 the indicated number of coats of camouflage insignia white acrylic nitrocellulose lacquer, Specification MIL-L-19538, color 37875.
364	-	Apply per Specification MIL-P-6808 the indicated number of coats of yellow primer, Specification MIL-P-8585, color Y, to enclosed surfaces by the fill and drain method.
365	64	Apply the indicated number of coats (0.8 to 1.2 mils each) of MIL-P-23377 epoxy primer in accordance with MIL-C-22751 except that the mixed primer may be stored up to 48 hours at a temperature of -20°F or below. Where the finish is called out 68/365, 68 may be omitted. The 68 shall be omitted on vacuum cadmium plated parts.
366	82	Apply the indicated number of coats of gloss white, MIL-C-22750(MOD) epoxy polyamide enamel, color 17875 per Specification MIL-C-22751 except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F. On U.S. Navy F-8 aircraft spares only, Code 392 shall replace Code 366.
367	65	Apply the indicated number of coats of camouflage light gull gray MIL-C-22750(MOD) epoxy polyamide enamel, color 36440 per Specification MIL-C-22751 except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F. On U.S. Navy F-8 aircraft spares only, Code 393 shall replace Code 367.
#	368	Apply the indicated number of coats of CVA 9-404 acrylic aluminumized enamel, color 17178 per Specification CVA 9-2.
369	-	Apply the indicated number of coats of MIL-P-8585 yellow primer to exterior surfaces of tubing per Specification CVA 9-53.
370	-	Blast clean plastic laminates per Specification CVA 9-131.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
371	63, 348	Apply the indicated number of coats of gloss orange-yellow MIL-C-22750(MOD) epoxy polyamide enamel, color 13538, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
372	62	Apply the indicated number of coats of camouflage dark gull gray MIL-C-22750(MOD) epoxy polyamide enamel, color 36231, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
373	61	Apply the indicated number of coats of camouflage black MIL-C-22750(MOD) epoxy polyamide enamel, color 37038, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
374	325	Apply the indicated number of coats of camouflage bright red MIL-C-22750(MOD) epoxy polyamide enamel, color 31136, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
375	80	Apply the indicated number of coats of camouflage orange-yellow MIL-C-22750(MOD) epoxy polyamide enamel, color 33538, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
376	349	Apply the indicated number of coats of modified gloss insignia red, MIL-C-22750(MOD) epoxy polyamide enamel, color 11136, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
377	347	Apply the indicated number of coats of modified gloss aircraft gray, MIL-C-22750(MOD) epoxy polyamide enamel, color 16473, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
378	335	Apply the indicated number of coats of modified gloss international orange, MIL-C-22750(MOD) epoxy polyamide enamel, color 12197, per Specification MIL-C-22751, except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
379	-	Apply the indicated number of coats of Specification 207-9-411, high reflecting white enamel per Specification 208-9-57.
380	-	Apply the indicated number of coats of Specification 207-9-411, high reflecting black enamel per Specification 208-9-57.
381	-	Apply the indicated number of coats of MIL-L-19538 acrylic lacquer camouflage dark green, color 34079, per Specification CVA 9-267.
382	-	Apply the indicated number of coats of MIL-L-19538 acrylic camouflage tan, color 30219, per Specification CVA 9-267.
383	-	Apply the indicated number of coats of MIL-L-19538 acrylic lacquer camouflage green, color 34102, per Specification CVA 9-267.
384	-	Apply the indicated number of coats of MIL-L-19538 acrylic lacquer camouflage gray, color 36622, per Specification CVA 9-267.
385	-	Apply the indicated number of coats of MIL-L-19538 acrylic lacquer camouflage black, color 37038, per Specification CVA 9-267.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
386	-	Apply the indicated number of coats of gloss black, MIL-C-22750(MOD) epoxy polyamide enamel, color 17038, per Specification MIL-C-22751 except the two components shall be mixed in a one-to-one ratio (by volume) and the mixed enamel may be stored up to 48 hours at a temperature not exceeding -20°F.
387	-	Dyeing of anodized aluminum, color black, per Specification CVA 13-14.
388	-	Dyeing of anodized aluminum, color red, per Specification CVA 13-14.
389	-	Apply 0.3 mil low embrittling cadmium to meet the requirements of Specification QQ-P-416 Class 2 Type II per Specification 208-5-15 Type II for touchup.
390	-	Anodize aluminum and aluminum alloys per Specification CVA 9-4 Type B. Parts which are to be adhesive bonded following anodizing shall not be sealed.
391	340	Apply per specification 208-9-71 white polyurethane coating material, Specification 207-9-427. In all cases where Code 340 was originally called out on drawings, the 391 system shall apply, regardless of the number of coats specified by the drawing.
392	-	Apply per specification 208-9-19 the indicated number of coats of gloss white, 207-9-414, polyurethane enamel, color 17875.
393	-	Apply per specification 208-9-19 the indicated number of coates of gloss light gull gray 207-9-414, polyurethane enamel, color 16440.
394	-	Apply per specification 208-9-19 the indicated number of coats of camouflage tan, Specification 207-9-414, polyurethane enamel, color 30219.
395	-	Apply per specification 208-9-19 the indicated number of coats of camouflage green, Specification 207-9-414, polyurethane enamel, color 34102.
396	-	Apply per specification 208-9-19 the indicated number of coats of camouflage dark green, Specification 207-9-414, polyurethane enamel, color 34079.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
397	-	Apply per specification 208-9-19 the indicated number of coats of camouflage gray, Specification 207-9-414, polyurethane enamel, color 36622.
398	-	Apply per specification 208-9-19 the indicated number of coats of camouflage black, Specification 207-9-414, polyurethane enamel, color 37038.
399	-	Apply per specification 208-9-80 black polyurethane rain erosion coating specification 207-9-427.
400	-	Apply per specification 208-9-19 the indicated number of coats of camouflage red, specification 207-9-414, polyurethane enamel, color 31136.
401	-	Apply per specification 208-9-19 the indicated number of coats of camouflage yellow, specification 207-9-414, polyurethane enamel, color 33538.
402	-	Apply per specification 208-9-19 the indicated number of coats of camouflage white, specification 207-9-414, polyurethane enamel, color 37875.
403	-	Apply per specification 208-9-19 the indicated number of coats of camouflage insignia blue, specification 207-9-414, polyurethane enamel, color 35044.
404	-	Apply per specification 208-9-19 the indicated number of coats of gloss jet black, specification 207-9-414, polyurethane enamel, color 17038.
405	-	Apply per specification 208-9-19 the indicated number of coats of gloss insignia blue, specification 207-9-414, polyurethane enamel, color 15044.
406	-	Apply per specification 208-9-19 the indicated number of coats of gloss red, specification 207-9-414, polyurethane enamel, color 11136.
407	-	Apply per specification 208-9-19 the indicated number of coats of camouflage dark gull gray, specification 207-9-414, polyurethane enamel, color 36231.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
408	-	Apply per specification 208-9-19 the indicated number of coats of gloss orange yellow, specification 207-9-414, polyurethane enamel, color 13538.
409	-	Apply per specification 208-9-80 white elastomeric polyurethane coating specification 207-9-427.
410(1)	-	Finish non-structural tubing in accordance with 208-9-54(1).
410(2)	-	Finish non-structural tubing in accordance with 208-9-54(2).
410(3)	-	Finish non-structural tubing in accordance with 208-9-54(3).
410(4)	-	Finish non-structural tubing in accordance with 208-9-54(4).
410(5)	-	Finish non-structural tubing in accordance with 208-9-54(5).
410(6)	-	Finish non-structural tubing in accordance with 208-9-54(6).
410(7)	-	Finish non-structural tubing in accordance with 208-9-54(7).
410(8)	-	Finish non-structural tubing in accordance with 208-9-54(8).
410(9)	-	Finish non-strucutral tubing in accordance with 208-9-54(9).
410(10)	-	Finish non-structural tubing in accordance with 208-9-54(10).
410(11)	-	Finish non-structural tubing in accordance with 208-9-54(11).
410(12)	-	Finish non-structural tubing in accordance with 208-9-54(12).
410(13)	-	Finish non-structural tubing in accordance with 208-9-54(13).
410(14)	-	Finish non-structural tubing in accordance with 208-9-54(14).

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
410(15)	-	Finish non-structural tubing in accordance with 208-9-54(15).
410(16)	-	Finish non-structural tubing in accordance with 208-9-54(16).
410(17)	-	Finish non-structural tubing in accordance with 208-9-54 (17).
410(18)	-	Finish non-structural tubing in accordance with 208-9-54(18).
410(19)	-	Finish non-structural tubing in accordance with 208-9-54(19).
410(20)	-	Finish non-structural tubing in accordance with 208-9-54(20).
410(21)	-	Finish non-structural tubing in accordance with 208-9-54(21).
410(22)	-	Finish non-structural tubing in accordance with 208-9-54(22).
410(23)	-	Finish non-structural tubing in accordance with 208-9-54(23).
410(24)	-	Finish non-structural tubing in accordance with 208-9-54(24).
411	-	Dye, anodized aluminum, color gold, per Specification CVA 13-14.
412	-	Hard anodize aluminum alloys per Specification CVA 2-186 Type I.
413	-	Hard anodize aluminum alloys per Specification CVA 2-186 Type II.
414	-	Gold plate per Specification MIL-G-45204.
415	-	Rhodium plate per Specification 208-5-17.
416	-	Nickel plate per Specification CVA 5-55, Type II.
417	-	Apply black chemical finish to copper alloys per Specification MIL-F-495.

TABLE III (Cont)

FINISH CODE NO. NEW	OLD	EXPLANATION
418	-	Zinc plate per Specification QQ-Z-325, Type II, Class 2.
419	-	Nickel cadmium diffused coating per AMS 2416.
420	-	Hard surface coating per Specification CVA 13-119.
421	-	Apply sanding sealer, 300B manufactured by Tenax Paint Products or equivalent, to exterior surfaces and sand smooth per Specification 208-9-37.
422	-	Apply vacuum deposited cadmium per Specification MIL-C-8837, Type II, Class 2.
423	-	Apply electroless nickel coating to aluminum per Specification 208-5-20.
424	-	Apply Specification 207-10-408 Type I air-drying solid film lubricant per Specification 208-10-10 Type I.
425	-	Hard anodize aluminum alloys per specification CVA 2-186, Type III.

TABLE IV

COLORS; LIST OF STANDARD AIRCRAFT CAMOUFLAGE
ANA BULLETIN NO. 157E

COLOR NAME	COLOR STANDARD TO BE EMPLOYED FED. STD. NO. 595	ANA COLOR NO.	SUPERSEDED ANA COLOR STANDARD
Instrument Black	1/ 27038	---	514
Insignia White	37875	---	601
Light Gray	36440	---	602
Sea Gray	36118	---	603
Black	37038	---	604
Insignia Blue	35044	---	605
Semi-Gloss Sea Blue	25042	---	606
Non-Specular Sea Blue	35042	---	607
Intermediate Blue	35164	---	608
Azure Blue	35231	---	609
Sky	34424	---	610
Interior Green	1/ 34151	---	611
Medium Green	34092	---	612
Olive Drab	34087	---	613
Orange-Yellow	33538	---	614
Middlestone	30266	---	615
Desert Sand (formerly Sand)	30279	---	616
Dark Earth	30118	---	617
Dull Red	30109	---	618
Bright Red	31136	---	619
Light Gull Gray	36440	---	620
Dark Gull Gray	36231	---	621
Seaplane Gray	26081	---	625
Semi-Gloss Insignia White	27875	---	626
Desert Drab	30219	---	628
Field Green	-----	627	---
Light Green	-----	630	---
Shadow Green	34079	---	631
Olive Green	-----	---	624

1/ Except gloss shall be 12 to 17.

TABLE V

COLORS; LIST OF STANDARD AIRCRAFT GLOSSY
ANA BULLETIN NO. 166E

COLOR NAME	COLOR STANDARD TO BE EMPLOYED FED. STD. NO. 595	COLOR STANDARD TO BE EMPLOYED ANA COLOR NO.	SUPERSEDED ANA COLOR STANDARD
Light Blue	15102	---	501
Insignia Blue	15044	---	502
Light Green	14187	---	503
Olive Drab	14087	---	504
Light Yellow	13655	---	505
Orange-Yellow	13538	---	506
Aircraft Cream	13594	---	507
International Orange	12197	---	508
Insignia Red	11136	---	509
Maroon	10049	---	510
Insignia White	17875	---	511
Aircraft Gray	16473	---	512
Engine Gray	16081	---	513
Gloss Black	17038	---	515
Strata-Blue	15045	---	516
Jet	17038	---	622
Glossy Sea Blue	15042	---	623
Fluorescent Red Orange	-----	633	---
Fluorescent Yellow-Orange	-----	634	---
Light Gull Gray	16440		

AMENDMENT NO. 1

OFFICIAL ENGINEERING RELEASE

PROCESS SPECIFICATION

SEALING COMPOUNDS, PREPARATION AND APPLICATION OF

APPLICABILITY:	This amendment forms a part of CVA 6-177 and is applicable wherever CVA 6-177 is called out.
CHANGE SUMMARY:	Added procedure for cleaning acrylic surfaces.
INCORPORATION DATE:	On or before 17 October 1975

MSF
Reviewed/Quality Engineering
Date 9-16-75
Signature Hoppenger

APPROVALS

PREPARING ACTIVITY	PROJ. ENGR.	TECH DATA SERVICES	COGNIZANT ACTIVITIES		
DATE 9/8/75	DATE 9.9.75	DATE 9-8-75	DATE	DATE	DATE

2-86100

Page 4, Paragraph 2.1, Federal Specifications, add the following:

P-D-680	Dry Cleaning Solvent
TT-T-291	Thinner-Paint, Volatile Spirits, Petroleum Spirits

Page 6, Paragraph 3.6.1, add the following:

(e) Mineral Spirits, Type I as specified in TT-T-291.

(f) Dry Cleaning Solvent, Type I as specified in P-D-680.

Page 14, add the following:

4.4.6 ACRYLIC SURFACES (CANOPIES, ETC.)

(a) Wipe dirt and oil from surface with a clean cloth wet with mineral spirits (TT-T-291, Type I) or dry cleaning solvent (P-D-680, Type I). Wipe surface dry with a clean cloth before cleaner evaporates.

NOTE

No other solvent shall be used on acrylic surfaces.

(b) Air dry a minimum of 15 minutes.

PREPARED BY: N. B. Armitage 2-53450 / J. E. Cook 2-50360	VOUGHT SYSTEMS DIVISION / LTV AEROSPACE CORPORATION / P.O. BOX 5907 · DALLAS, TEXAS 75222	NO. CVA 6-177N
DISTRIBUTION X	ENGINEERING DEPARTMENT SPECIFICATION	PAGE 1 OF 33
CODE IDENT NO. 80378	CONTR NO.	DATE 1 October 1974

PROCESS SPECIFICATION

OFFICIAL ENGINEERING RELEASE

SEALING COMPOUNDS, PREPARATION AND APPLICATION OF

APPLICABILITY:	This specification is applicable wherever CVA 6-177 is called out.
CHANGE SUMMARY:	(1) Incorporated outstanding amendments.
	(2) Revised safety precautions.
	(3) Revised cleaning procedures.
INCORPORATION DATE:	On or before 1 November 1974

The symbol ø indicates changes or additions over the previous issue.

MSF
Reviewed/Quality Engineering
Date 18 Sept. 1974
Signature

APPROVALS

PREPARING ACTIVITY	PROJ. ENGR.	TECH DATA SERVICES	COGNIZANT ACTIVITIES		
					NAVY
DATE 9/5/74	DATE 9-14-74	DATE 8-30-74	DATE	DATE	DATE September 29, 1974

2-56100 R7

1. SCOPE

1.1 PURPOSE - This specification establishes the procedures for the preparation and application of sealing compounds to produce seals as defined in Table I.

1.2 DESIGN CALLOUTS - Engineering drawings or specifications will refer to this specification number plus a number in parenthesis which will indicate the type of seal required for a particular application. Equivalent drawing callouts used prior to 25 February 1963 are also included. Drawing callouts on Engineering drawings shall be in accordance with Table I.

TABLE I

DRAWING CALLOUTS DESIGNATING TYPES OF SEAL

DRAWING CALLOUT		TYPES OF SEAL	DESCRIPTIVE PARAGRAPH
NEW	OLD**		
Spec CVA 6-177(1)	Faying Surface Seal Per CVA 6-177	Faying Surface Seal	4.5.4
	Faying Surface Seal Per CVA 177		
	Spec CVA 6-177		
	Seal Faying Surfaces with High Temperature Sealant Per Spec CVA 177		
Spec CVA 6-177(2)	Fillet Seal Per CVA 177	Fillet Seal	4.5.5
	Fillet Seal Per CVA 6-177		
Spec CVA 6-177(3)	Caulk Seal Per CVA 177	Caulk Seal	4.5.6
	Caulk Seal Per Spec CVA 6-177		
	Caulk with High Temperature Sealant Per Spec CVA 177		

TABLE I (Continued)

DRAWING CALLOUT		TYPES OF SEAL	DESCRIPTIVE PARAGRAPH
NEW	OLD**		
Spec CVA 6-177(4)	Gusset Seal Per CVA 177 Gusset Seal Per Spec CVA 6-177	Gusset Seal	4.5.7
Spec CVA 6-177(5)	Apply EC-1293 Compound Per Spec CVA 177	Faying Surface Seal Applied to Increase Fatigue Strength of a Riveted Joint	4.5.8
Spec CVA 6-177(6)	Install Fastener with Thinned Sealand Per CVA 177	Fastener Dip Seal	4.5.9
Spec CVA 6-177(7)	Bond with EC-1293 Compound Applied Per Spec CVA 177	Cold Bonding (Non-structural or Limited)	4.5.10
Spec CVA 6-177(8)	Corrosion Protection Seal Per Spec CVA 6-177 92S CVA 92S CVA 9-92(7)	Corrosion Protection Faying Surface Seal	4.5.11
Spec CVA 6-177(9)	- -	Corrosion Protection of Magnesium Surfaces to be Spotwelded	4.5.12
Spec CVA 6-177(10)	- -	Receptacle Seal	4.5.13
Spec CVA 6-177(11)	- -	Vibration Damping Sealant	4.5.14
Spec CVA 6-177(12)	- -	Press Fit Seal	4.5.15
Spec CVA 6-177(13)	- -	Fluid Resistant Topcoat	4.6

TABLE I (Continued)

DRAWING CALLOUT		TYPES OF SEAL	DESCRIPTIVE PARAGRAPH
NEW	OLD**		
Spec CVA 6-177(14)	- -	Corrosion Protection of Pinned Joint	4.7

**These callouts shall not be used on drawings released after 25 February 1963.

NOTE

Whenever the following callouts are specified on Engineering drawings after this specification number, the sealant material indicated below shall be used; otherwise only the heat resistant sealant shall be used.

(HR) - Heat resistant sealant prepared in accordance with 4.2.1 or 4.3.

(FR) - Flame resistant sealant prepared in accordance with 4.2.2.

(T) - Thinned sealant prepared in accordance with 4.2.3.

(F) - Filled sealant prepared in accordance with 4.2.4.

(QR) - Use CVA 6-579, Class B-1.

2. APPLICABLE DOCUMENTS

2.1 The applicable provisions of the following documents are incorporated herein by reference:

SPECIFICATIONS

FEDERAL

QQ-A-250/13 Aluminum Alloy Alclad 7075, Plate And Sheet

TT-M-261	Methyl-Ethyl-Ketone (For Use In Organic Coatings)
TT-M-268	Methyl Isobutyl Ketone (For Use In Organic Coatings)
TT-N-97	Naphtha, Aromatic
TT-T-548	Toluene, Technical

MILITARY

	MIL-S-4383	Sealing Compound, Topcoat, Fuel Tank, Buna-N Type
	MIL-P-8585	Primer Coating, Zinc Chromate, Low Moisture Sensitivity
	MIL-C-9084	Cloth, Glass, Finished, For Polyester Resin Laminates
	MIL-C-18718	Cleaning Compound, Solvent
ϕ	MIL-T-19544	Thinner, Acrylic-Nitrocellulose Lacquer
ϕ	MIL-T-81533	1,1,1 Trichloroethane (Methyl Chloroform) Inhibited, Vapor Degreasing

VSD

CVA 6-99	Cementing Of Rubber Parts
CVA 6-579	Sealant, Heat Resistant, 250°F Service Temperature
CVA 9-17	Metallic Surfaces, Treatment Of, For Paint Adhesion
CVA 9-18	Alodine Chemical Film For Aluminum And Aluminum Alloys
CVA 9-92	Protection Of Metal-To-Metal Contacts
CVA 13-225	Fasteners, Rivet And Rivet Type, Requirements For
CVA 17-5	Welding, Resistance, and Cleaning Of Magnesium Alloys

STANDARDS

FED-STD-601	Rubber, Sampling And Testing

2.2 In the event this specification does not meet or exceed the requirements of any applicable government specification, the government specification shall take precedence unless a deviation has been granted.

3. MATERIALS AND EQUIPMENT

3.1 MATERIALS

3.1.1 CLEANERS

(a) Toluene, as specified in TT-T-548.

(b) Trichloroethane, as specified in MIL-T-81533.

(c) Mild Acid Cleaner, TEC 901, as manufactured by TEC Chemical Co., Monterey Park, Calif.*

(d) Thinner, as specified in MIL-T-19544.

3.1.2 Sealant, Heat Resistant, as specified in CVA 6-579.

3.1.3 Fluid Resistant Topcoat, as specified in MIL-S-4383.

3.1.4 THINNERS

(a) Methyl-Ethyl-Ketone, as specified in TT-M-261.

(b) Methyl Isobutyl Ketone, as specified in TT-M-268.

3.1.5 Ammonium Monobasic Phosphate, ($NH_4H_2PO_4$), analytical regent, 100 mesh.

3.1.6 Phenolic Micro-balloons, as manufactured by the Plastics Division of Union Carbide and Carbon Corp., N. Y., N. Y.*

3.1.7 Naphtha, Type I, as specified in TT-N-97.

3.1.8 Safety Solvent, as specified in MIL-C-18718.

3.1.9 Barrier Cream, commercial grade for hand protection, as approved by VSD Safety Department.

3.1.10 Zinc Chromate Primer, as specified in MIL-P-8585.

3.1.11 Polyethylene Sheet, no slip, untreated, virgin film, SP.G. .916-.92, commercial grade.

3.1.12 Macro Bronze No. 4, as manufactured by MacDermid Inc., Waterbury, Conn.*

3.1.13 Asbestos, Baker; long, washed and ignited fiber.*

3.1.14 Cloth, Glass Fabric, as specified in MIL-C-9084 Type VIIIA

3.2 EQUIPMENT

3.2.1 Air Pressure Gun, Semco, as manufactured by Semco Sales and Service, Inglewood, Calif.*

3.2.2 Spray Gun, De Vilbiss MBC, as manufactured by the De Vilbiss Co., Toledo, Ohio.*

3.2.3 Spatulas, commercial grade.

3.2.4 Brushes, stiff bristle, commercial grade.

3.2.5 Sealant Mixing Machine, as manufactured by Pyles Industries, Inc., Wixom, Mich.*

3.2.6 Drag Templates, TS412.018.*

3.2.7 Gloves, plastic or rubber, as approved by VSD Safety Department.

3.2.8 Rags, clean, Grade A or new white shop towels.

*Or equivalent as approved by Engineering Materials.

4. PROCEDURES

Φ 4.1 SAFETY PRECAUTIONS

4.1.1 MILD ACID CLEANER - When using mild acid cleaner, strict safety and fire precautions shall be ovserved. Rubber gloves shall be worn and the material shall be used in a ventilated area. If used in a closed area, forced air ventilation shall be provided and a suitable respirator shall be worn by the worker. The mild acid cleaner shall be transported and stored in plastic-lined containers.

4.1.2 TOPCOAT - Employees applying topcoat shall wear rubber gloves or protect their hands with barrier cream.

4.1.3 MIL-T-81533 TRICHLOROETHANE

WARNINGS

AVOID PROLONGED OR REPEATED CONTACT WITH THE SKIN.

WEAR PLASTIC OR RUBBER GLOVES WHEN WORKING WITH THE SOLVENT.

AVOID PROLONGED OR REPEATED BREATHING OF VAPOR. NEVER WORK WITH ANY SOLVENT IN A CONFINED SPACE OR AREA WITHOUT MECHANICAL VENTILATION OR RESPIRATORY PROTECTION.

DO NOT USE WHERE SOLVENT IS IN CONTACT WITH AN OPEN FLAME SUCH AS WELDING OR IN SMOKING AREAS. THIS SOLVENT BREAKS DOWN TO A MORE TOXIC MATERIAL UNDER THOSE CONDITIONS.

4.2 HAND MIXING METHOD

4.2.1 Process CVA 6-579 B-8, B-4, B-2 1/2 and B-1 heat resistant sealant as follows:

(a) WEIGHING - Stir base compound and accelerator in their separate containers. Using ratios established by manufacturer, weight of base compound and accelerator shall be within ±1% of combined weight. Accelerator tolerance shall be ±2% by weight. Refer to 4.2.6 for weighing instructions for sealant used between spot welded magnesium surfaces.

NOTE

Omit weighing when sealant is packaged in predetermined quantities and the entire package is to be used.

(b) MIXING - When authorized by Quality Assurance, hand mix small quantities of sealant in non-absorbent containers, or on a non-absorbent surface, using a spatula to fold accelerator into base compound. Continue mixing until all accelerator flecks or lumps are removed; if flecks or lumps cannot be eliminated, reject mixture.

NOTE

If sealant is to be applied by an air pressure gun, place sealant in a polyethylene container immediately after mixing and keep container closed until needed.

4.2.2 FLAME RESISTANT SEALANT - Add 32 parts (by weight) of 100 mesh ammonium monobasic phosphate to 68 parts (by weight) of mixed heat resistant sealant and stir until a homogenous blend is obtained.

NOTE

When not in use, keep container of ammonium monobasic phosphate closed as this material will accumulate moisture from air and become damp, caked and unusable.

Φ **4.2.3 THINNED SEALANT - Add 10 parts (by weight) of toluene or methyl-ethyl-ketone to 100 parts (by weight) of the heat resistant base compound and mix with the accelerator; stir until a homogenous blend is obtained.**

4.2.4 FILLED SEALANT - Add phenolic micro-balloons to the mixed heat resistant sealant in the ratio of 1 to 1 (by volume) and stir until a homogenous blend is obtained.

4.2.5 VIBRATION DAMPING SEALANT - Add 10% (by weight) of asbestos to the thinned sealant prepared in accordance with 4.2.3 and stir until a homogenous blend is obtained.

4.2.6 WELD-THRU SEALANT FOR USE WITH MAGNESIUM ALLCYS - Using B-2 1/2 heat resistant sealant, weigh and mix in accordance with 4.2.1, except the mixture shall contain only 50% of the recommended amount of accelerator and shall have 10% (by weight) of toluene added to the mixture.

Φ 4.3 MACHINE MIXING METHOD - Machine mixing is the preferred method for production purposes; however, being mechanical and subject to part failures, dis-proportionate ratios of ingredients or non-homogenous mixtures can result. Therefore, to assure good quality sealants, periodic examination and certification of the product and mixing equipment is mandatory.

4.3.1 STORAGE OF MACHINE-MIXED SEALANTS - Machine-mixed sealants shall be stored in closed polyethylene containers at a temperature of -20°F or lower for a period of 15 days maximum. The polyethylene container shall be closed with a polyethylene cap or by other methods approved by Quality Assurance. The mixed sealant shall be placed in the containers immediately after mixing; in no instance shall this period of time exceed 15 minutes from the time of mixing. Immediately "quick freeze" the containers of mixed sealant by immersing containers in a mixture of TT-N-97 Type I naphtha or MIL-C-18718 safety solvent and dry ice to a depth sufficient to cover all sides of the container adjacent to the sealant for a period of 10 minutes, minimum. Quick freeze media shall not be allowed in the cartridge.

Φ 4.3.2 TESTS - Prior to using machine-mixed sealants in production and periodically thereafter, Quality Assurance shall take samples and perform the tests specified in 4.3.2.1 through 4.3.2.4.

4.3.2.1 FLOW - The flow shall be between 0.10 inch and 0.50 inch for CVA 6-579 Class B-2 1/2, Class B-4, and B-8 sealants and between 0.20 inch and 0.60 inch for Class B-1 sealant when tested as follows:

(a) Place flow test jig (refer to CVA 6-579) face upward on a table and depress plunger to limit of its depth.

(b) Within 15 minutes after mixing (or after thawing, if frozen), extrude sealant from an air pressure gun into recessed cavity and level off even with face of jig.

(c) Within 10 seconds after leveling, place jig in a vertical position and advance plunger to limit of its forward travel.

(d) Record flow measurement at 30 minutes.

4.3.2.2 HARDNESS - The reading on the hardness scale shall be a minimum of 35 when tested as follows:

(a) Immediately after mixing (or after thawing if frozen), pour a quantity of sealant onto a non-reactive surface to a thickness not less than 0.25 inch.

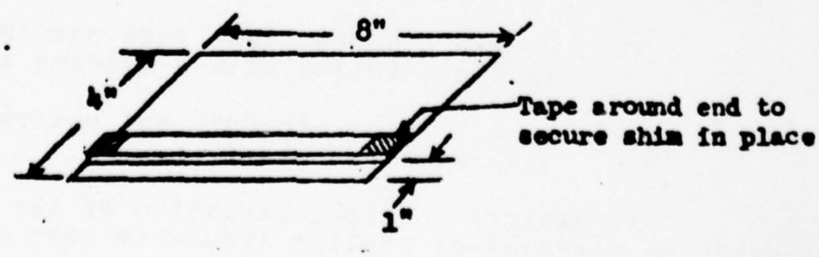
(b) Cure for 4 hours at 180°F ±10°F.

(c) Cool to room temperature and immediately determine instantaneous hardness in accordance with Federal Test Method Standard No. 601, Method 3021.

4.3.2.3 SHEAR STRENGTH - Each specimen shall have a minimum shear strength of 150 psi. Failure of each specimen shall be cohesive when tested as follows:

(a) Clean and alodine in accordance with CVA 9-18 two panels 0.063 inch x 4 inch x 8 inch of 7075 T6 clad aluminum (QQ-A-250/13).

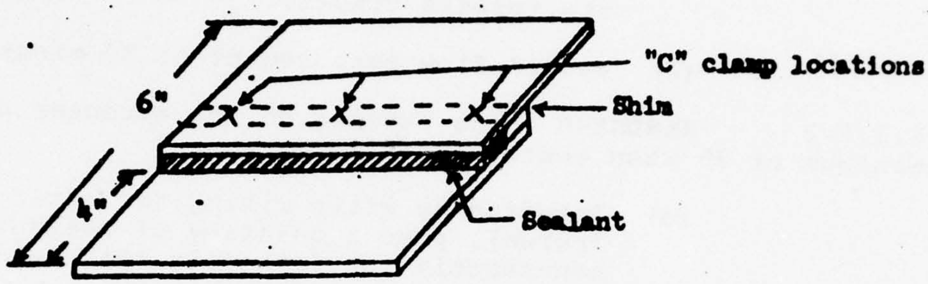
(b) Affix a shim, 0.012 inch x 1 inch x 8 inch 7075 T6 clad aluminum sheet (QQ-A-250/13) or other suitable material to one panel 1 inch from edge with tape as shown.



(c) Immediately after mixing (or after thawing if frozen), apply sealant to 1 inch wide area between shim and edge of panel spreading with tongue depressor to control thickness and assure wetting of

the alodined surface. Apply very thin film of sealant to area of other panel which will contact the 1 inch wide band of sealant in the assembled position.

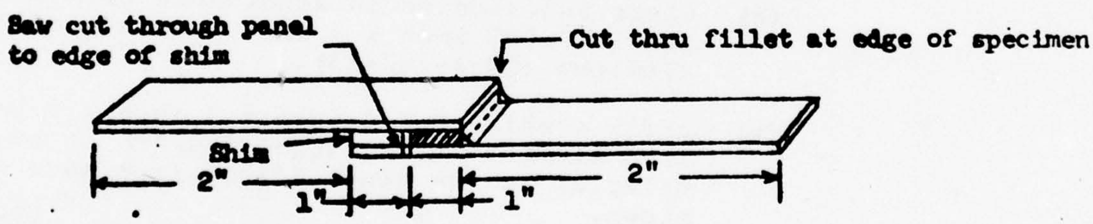
(d) Assemble sealant coated panels as shown.



(e) Using "C" clamps above shim location, apply pressure to squeeze out excess sealant and wipe to remove excess sealant. Sealant thickness shall be 0.010 inch ±0.005 inch.

(f) Cure assembled panels fcr 4 hours at 180°F ±10°F.

(g) Cool to room temperature and saw cut specimens from panel as shown.



(h) Within 8 hours, test each specimen in a tensile type testing machine with a lcading rate of 4000 lbs/min.

(i) Record shear strength and nature of failure (adhesive or cohesive).

4.3.2.4 APPEARANCE - Slight variation of the cut section may be acceptable on approval of Quality Assurance when tested as follows:

(a) Immediately after mixing (or after thawing if frozen), extrude a 6 inch minimum bead of sealant from an air pressure gun (without using the restrictive nozzle) on a clean 7075-T6 clad aluminum alloy panel (QQ-A-250/13).

(b) Cure for 4 hours at 180°F ±10°F.

(c) Cool to room temperature and immediately slit sealant in half using a sharp knife with blade held parallel to panel.

(d) Observe cut section for streaks or variation in color.

4.3.3 ACCEPTANCE - Failure to pass any of the tests required by 4.3.2 shall be cause for rejection of the machine mixed sealant.

4.4 PREPARATICN OF SURFACES

4.4.1 CLEANING - Clean all surfaces to be sealed as follows:

(a) Remove chips and dirt from slots and holes.

ϕ (b) Wipe dirt, oil, and grit from surfaces as follows:

(1) ASSEMBLIES WITHOUT TITANIUM COMPONENTS - Assemblies which do not contain titanium components shall be cleaned by wiping with a clean cloth wet with MIL-T-81533 trichloroethane (see 4.1.3). Wipe off solvent with a dry clean cloth before solvent evaporates.

(2) ASSEMBLIES WITH TITANIUM COMPENENTS - Assemblies which contain titanium components shall be cleaned by wiping with a clean cloth wet with TT-M-261 methyl-ethyl-ketone, TT-T-548 toluene, or MIL-T-19544 lacquer thinner (if none of these solvents are available, consult Engineering Materials). Wipe off solvent with a dry clean cloth before solvent evaporates.

ϕ (c) Wipe surfaces with a cloth wet with mild acid cleaner (see 4.1.1); then wipe dry with a clean cloth before cleaner dries.

(d) Blow out slots and holes with filtered air.

(e) Air dry a minimum of 15 minutes.

(f) If sealant is not applied immediately, cover cleaned surfaces with a clcth or paper to prevent contamination. Reclean surfaces if more than 8 hours elapse before applying sealant.

ϕ 4.4.2 REPRIMING - If primer is removed during the cleaning operation, apply the sealant over the bare metal. After application of the sealant, reprime any exposed areas of bare metal with the specified primer.

4.4.3 All cadmium or zinc plated surfaces shall be treated with Macro Bronze No. 4 in accordance with CVA 9-17 prior to application of sealant.

ϕ 4.4.4 RESIN IMPREGNATED LAMINATED SURFACES

(a) Remove chips and dirt from slots and holes.

ϕ (b) Wipe dirt, oil, and grit from surfaces as specified in 4.4.1(b).

(c) Vapor blast or sand lightly with sandpaper to remove all gloss. Exposure of glass fibers shall be kept to a minimum.

ϕ (d) Wipe dirt, oil, and grit from surfaces as specified in 4.4.1(b).

(e) Blow out slots and holes with dry, compressed, filtered air.

(f) Air dry a minimum of 15 minutes.

(g) If sealant is not applied immediately, cover cleaned surfaces with cloth or paper to prevent contamination. Reclean surfaces if more than 8 hours elapse before applying sealant.

4.4.5 WOOD SURFACES

(a) Sandpaper lightly.

(b) Remove sanding dust by wiping with a clean cloth or by dry, filtered, compressed air.

4.5 APPLICATION OF HEAT RESISTANT SEALANT

4.5.1 PERSONNEL QUALIFICATION - The sealant shall be applied only by personnel who have satisfactorily completed the VSD Sealant Training Class.

4.5.2 APPLICATION TOOLS - The sealant shall be applied with an air pressure gun except in those areas where Quality Assurance determines the gun application method to be impracticable. For those areas, a spatula, putty knife, serrated plastic scraper, or stiff bristle brush shall be used to apply the sealant.

4.5.3 FINISHED SEAL - The sealant dimensions shall be controlled by drag templates or other suitable tools such as TS412.018. The sealant may be smoothed with a clean cloth dampened with water. The finished seals shall be continuous and unbroken.

4.5.4 FAYING SURFACE SEAL -- Drawing Callout "SPEC CVA 6-177(1)"

NOTE

This type of seal is applicable for all similar and dissimilar metal contacts except when one or both metals are magnesium. When one or both of the contacting metals are magnesium, seal the faying surfaces in accordance with 4.5.11.

(a) Clean all surfaces to be sealed in accordance with 4.4.

(b) Completely coat one faying surface with sealant 1/32 inch ±1/64 inch in thickness.

(c) Immediately assemble parts to obtain a squeeze-out of sealant along entire assembly. If assembly sequences require permanent fasteners to be installed later, use Cleco or other similar fasteners to obtain a squeeze-out of sealant equal to or approaching that obtained by permanent fasteners. The installed fasteners shall be in accordance with the requirements of CVA 13-225.

NOTE

"Immediately" shall be interpreted to mean within application time of sealant being used. (1 hour for B-1, 2 1/2 hours for B-2 1/2, 4 hours for B-4, 8 hours for B-8 after mixing if not frozen, or after thawing to room temperature if frozen. B-1 shall be thawed by immersing sealant tube in warm water, approximately 120°F).

(d) Remove squeeze-out of sealant so that a fillet similar to those in Figure 1 and Figure 2 is obtained.

(e) Allow sealant to cure until tack free before removing temporary fasteners.

(f) The sealant shown between 2 butt sheets in Figure 1(b) shall not be required on A-7 where butting sheets are separated by 0.015 inch or less.

4.5.5 FILLET SEAL -- DRAWING CALLOUT "SPEC CVA 6-177(2)" - Clean all surfaces to be sealed in accordance with 4.4. Lay a fillet along the parts as shown in Figure 3 and work the sealant into the fillet shape shown in Figures 4 and 5 using drag templates or other similar tools to obtain correct dimensions.

4.5.6 CAULK SEAL -- DRAWING CALLOUT "SPEC CVA 6-177(3)" - Clean all surfaces to be sealed in accordance with 4.4. Apply sealant to openings backed by continuous structure as shown in Figure 6. Apply sealant to openings not backed by structure as shown in Figures 7, 8, and 9. Keep use of sealant to a minimum and, where possible, use drag templates or other similar tools to obtain the correct dimensions.

NOTE

Clean surfaces and apply sealant to holes less than 1/4 inch that have been created in the structure by tooling.

4.5.7 GUSSET SEAL -- DRAWING CALLOUT "SPEC CVA 6-177(4)"

(a) Clean all surfaces to be sealed in accordance with 4.4. Cut glass fabric cloth to cover the opening plus approximately 3/4 inch overlap on each surface.

NOTE

Prior to cutting, the glass fabric cloth may be coated on both sides with fluid resistant topcoat material or may be coated on the side adjacent to the structure with heat resistant sealant.

(b) Apply a thin layer of sealant to the metal surfaces, press the glass fabric cloth in place and overcoat the entire gusset with sealant. Feather out the sealant beyond the edges of the glass fabric cloth using a stiff bristle brush. Refer to Figures 10 and 11 for typical examples.

NOTE

Clean surfaces and apply a gusset seal to holes 1/4 inch to 1/2 inch that have been created in the structure by tooling.

4.5.8 FAYING SURFACE SEAL APPLIED TO INCREASE FATIGUE STRENGTH OF A RIVETED JOINT -- DRAWING CALLOUT "SPEC CVA 6-177(5)" - Clean all surfaces to be sealed in accordance with 4.4 and apply sealant in accordance with 4.5.4.

NOTE

This designation is separated from faying surface sealing as a method of alerting all concerned that the sealant is performing an additional function over and above sealing in these particular applications.

4.5.9 FASTENER DIP SEAL -- DRAWING CALLOUT "SPEC CVA 6-177(6)" - Clean all surfaces to be sealed in accordance with 4.4. Dip shank of fastener into the heat resistant sealant and insert immediately into hole. Wipe sealant from the exposed shank. If Hi-Shear rivets and Huck lockbolts are dipped, insure that all sealant is removed from the locking grooves. Install the fastener in accordance with CVA 13-225.

ϕ 4.5.10 COLD BONDING (LIMITED OR NON-STRUCTURAL) -- DRAWING CALLOUT "SPEC CVA 6-177(7)" - Metal surfaces to be bonded shall be cleaned in accordance with 4.4. Resin impregnated surfaces shall be lightly sanded to remove the surface glaze, wiped with suitable solvent, wiped dry with a clean cloth and bonded. The bonding procedures shall be in accordance with 4.5.4 except clamping or other pressure shall be applied to secure parts in close contact. Apply enough pressure to obtain a squeeze-out of sealant along all edges and remove the squeeze-out to form a fillet similar to those shown in Figures 1(a) and 2. Allow the sealant to cure until tack free before removing clamps. Rubber surfaces shall be cleaned and bonded in accordance with CVA 6-99.

4.5.11 CORROSION PROTECTION FAYING SURFACE SEAL -- DRAWING CALLOUT "SPEC CVA 6-177(8)"

NOTE

This type of seal is applicable for metal contacts when one or both of the contacting metals are magnesium.

(a) Clean all surfaces to be sealed in accordance with 4.4 and apply sealant in accordance with 4.5.4. Form a fillet and fair the squeeze-out of sealant over the metal as shown in Figure 12 except when the

vertical surface at the edge of the faying surface is greater than 1/4 inch.

NOTE

When this surface is greater than 1/4 inch, the sealant need not be faired over the edge, but it shall extend up the vertical surface a minimum of 1/4 inch.

(b) If closure of a cavity prevents access to obtain the required configuration, cover the metal surface with sealant 1/4 inch to 3/8 inch beyond the edge of the faying surfaces and fairing of the sealant over the edge as shown in Figure 12 shall not be required.

4.5.12 CORROSION PROTECTION OF MAGNESIUM SURFACES TO BE SPOTWELDED -- DRAWING CALLOUT "SPEC CVA 6-177(9)" - Sealant to be used for this application shall be mixed in accordance with 4.2.6. The instructions of 4.3 shall not be applicable to this mixture. Frozen sealant shall not be used. Clean all surfaces to be sealed in accordance with CVA 17-5. Immediately after cleaning, apply a bead of sealant to the mating surfaces with an air pressure gun. Apply enough sealant to insure a squeeze-out of sealant from all edges after spotwelding. Lay the mating surfaces together and spotweld immediately. As indicated in Figure 13, either remove the squeeze-out of sealant or let the squeeze-out form a natural fillet without any fairing.

4.5.13 RECEPTACLE SEAL -- DRAWING CALLOUT "SPEC CVA 6-177(10)" - Clean all surfaces to be sealed in accordance with 4.4. Treat the receptacle surface to be sealed by applying Macro Bronze No. 4 (CVA 9-17) with a stiff brush or swab for 2 minutes; then swab with cloths wet with water and wipe dry with a clean dry cloth. Apply sealant over the entire lower portion of the receptacle so that the sealant covers the fasteners and 0.12 inch to 0.18 inch of the adjacent metal as shown in Figure 14.

4.5.14 VIBRATION DAMPING SEALANT -- DRAWING CALLOUT "SPEC CVA 6-177(11)" - Clean all surfaces to be sealed in accordance with 4.4. Completely cover the surface with a 1/8 inch ±1/16 inch coat of sealant prepared in accordance with 4.2.5.

4.5.15 PRESS FIT SEAL -- DRAWING CALLOUT "SPEC CVA 6-177(12)" - Clean all surfaces to be sealed in accordance with 4.4. When a press fit part is installed, seal as shown in Figure 15.

4.5.16 ROOM TEMPERATURE CURING

(a) TACK FREE CURING - Allow sealant to cure until tack free (approximately 15 hours for B-1; approximately 18 hours for B-2 1/2, approximately 36 hours for B-4, approximately 72 hours for B-8) before working in the sealed area. If it is necessary to work in the sealed area before this time, cover sealant with a polyethylene sheet. Remove polyethylene sheet only after sealant is tack free. Zinc chromate primer (MIL-P-8585) may be used in lieu of polyethylene sheet.

(b) FULL CURING - Allow sealant to cure for a minimum of 24 hours for B-1, 72 hours for B-2 1/2, 90 hours for B-4, and 168 hours for B-8 prior to pressure testing. Testing before this time will require approval of Quality Control, but in no instance shall pressure test be made prior to the sealant being tack free.

4.5.17 ELEVATED TEMPERATURE CURING - Apply heat at 160°F ±10°F until the sealant is tack free (approximately 3 to 8 hours depending on the class of sealant used).

4.5.18 SEALANT REPAIR - When sealant repair is authorized, repair or patch as follows:

(a) Remove all defective sealant by cautiously shaving or sanding, exercising care not to remove chemical film.

(b) Clean all surfaces to be sealed in accordance with 4.4.

(c) Apply sealant in accordance with the applicable sealant application method paragraph.

(d) Allow sealant to cure until tack free.

4.6 APPLICATION OF FLUID RESISTANT TOPCOAT -- DRAWING CALLOUT "SPEC CVA 6-177(13)"

4.6.1 FACILTIY AND EQUIPMENT

(a) All hand tools used in this procedure shall be spark proof.

(b) All motors used in this process shall be explosion proof.

(c) All lights used in the work area shall be vapor proof.

(d) Ventilation shall be provided to keep toxic vapors below 100 parts of vapor per million parts of air in work area.

(e) Smoking shall not be allowed in the work area.

CAUTION

VAPORS FROM MATERIAL USED IN THIS PROCESS ARE EXPLOSIVE. EVERY EFFORT AND PRECAUTION SHALL BE TAKEN TO PREVENT IGNITION OF THESE VAPORS.

ϕ (f) Sealed areas designated in the normal operation or servicing of the aircraft to be continuously or intermittently exposed to hydraulic fluids, fuel, lubricating oil, or glycerine, such as the disconnection of hydraulic lines for removal of a part, shall be overcoated with fluid resistant topcoat. All fuel cell cavities shall have fluid resistant topcoat applied over all exposed surfaces.

4.6.2 PREPARATION OF SURFACES

4.6.2.1 CLEANING - Clean all surfaces to be sealed as follows:

(a) Remove chips and loose particles.

ϕ (b) Wipe dirt, oil and grit from surfaces as specified in 4.4.1(b).

ϕ (c) Wipe surfaces with a cloth wet with mild acid cleaner (see 4.1.1); then wipe dry with a clean cloth before cleaner evaporates.

NOTE

Start this cleaning operation from the farthest point in the cavity and proceed toward the access area, thus insuring no contamination on the cleaned surface.

(d) Air dry for a minimum of 15 minutes.

(e) If topcoat is not applied immediately, cover cleaned surface with a cloth or paper to prevent contamination. Reclean surfaces if more than 8 hours elapse before applying topcoat.

Φ 4.6.3 TOPCOAT APPLICATION METHOD - All fuel cell cavities shall be topcoated (see 4.1.2) by one of the following methods as required by the applicable Engineering drawings or specifications. Every effort shall be made to produce uniform coatings; however, due to extreme difficulty of measuring coatings in corners and over fasteners, all thickness readings shall be made on flat or relatively flat surfaces.

4.6.3.1 FILL AND DRAIN

(a) Close all openings, holes, and accesses.

(b) Subject cavity to a pressure of 1 psi and turn pressure valve off. Wait 30 seconds and check gage for a positive pressure. If gage does not indicate a positive pressure, the cavity leak shall be found and repaired with heat resistant sealant.

(c) Allow an overflow hole in uppermost corner of cavity and fill cavity with fluid resistant topcoat until it overflows hole.

(d) Close overflow hole and subject cavity to a pressure of 2 psi for 15 minutes.

(e) Drain topcoat material from cavity.

(f) Immediately open access holes and brush or spray fluid resistant topcoat material to any area not covered by fill and drain process. Attach an aspirator to one access hole and to a ground lead.

(g) Allow topcoat to cure at room temperature until tack free (4 hours) with aspirator exhausting vapors from cavity. Do not blow air into cavity.

(h) Check for a thickness of 0.0015 inch to 0.0040 inch. If thickness is not in this range, repeat steps (c) through (g) until correct thickness is obtained. Minor running of topcoat from under hat sections, etc., which exceeds 0.004 inch will be acceptable providing it is thoroughly cured and devoid of pinholes.

(i) Aspirate cavity for 8 hours minimum to complete cure. Do not blow compressed air into cavity.

4.6.3.2 BRUSH - Apply the fluid resistant topcoat with a brush to obtain a thickness of 0.0015 inch to 0.0040 inch. If more than one coat is necessary, allow each coat to cure at room temperature until tack free (approximately 4 hours).

4.6.3.3 SPRAY - Thin the fluid resistant topcoat in the volume proportions shown in Table II. Apply the topcoat with a spray gun to obtain a thickness of 0.0015 inch to 0.0040 inch. If more than one coat is necessary, allow the topcoat to cure at room temperature for 15 minutes between coats and allow the final coat to cure at room temperature until tack free (approximately 4 hours).

ϕ 4.6.3.4 SLOSH AND DRAIN - Apply the fluid resistant topcoat (see 4.1.2) as follows:

(a) Close all openings, holes and accesses.

(b) Perform leakage tests in accordance with applicable fuel cell cavity sealing and pressure testing specification for the particular aircraft model.

(c) Install a sufficient quantity of fluid resistant topcoat in the cavity to assure that all surfaces of cavity will become immersed as cavity is rotated.

(d) Rotate cavity in 2 directions 180° apart so that all internal surfaces, crevices and corners have been submerged.

(e) Drain topcoat material from cavity.

(f) Immediately open access holes and brush or spray topcoat material to any area not covered by this "slosh and drain" procedure.

(g) Attach an aspirator to one access hole and to a ground lead.

(h) Allow topcoat to cure at room temperature until tack free (4 hours) with aspirator exhausting vapors from cavity. Do not blow air into cavity.

(i) Check for a thickness of 0.0007 inch to 0.0040 inch. If the thickness is not in this range, repeat steps (c) through (f) until the correct thickness is obtained. Minor running of topcoat from under hat sections, etc., which exceeds 0.004 inch will be acceptable providing it is thoroughly cured and devoid of pinholes.

(j) Aspirate cavity for 8 hours minimum to complete cure. Do not blow compressed air into cavity.

4.7 CORROSION PROTECTION OF PINNED JOINT -- DRAWING CALLOUT "SPEC CVA 6-177(14)"

(a) Clean all mating surfaces of the joint in accordance with 4.4.

(b) Completely coat the cleaned mating surfaces of the joint, except the pin and insides of pin holes, with a coat of "thinned sealant" prepared in accordance with 4.2.3.

(c) Immediately assemble the joint, insert the pin to its permanent position and clean up excess sealant squeeze-out.

5. QUALITY ASSURANCE PROVISIONS - Quality Assurance shall maintain adequate surveillance to insure that all requirements and procedures of this specification are met.

6. NOTES

6.1 INTENDED USE - The sealing compounds of this specification are used for sealing faying surfaces, prevention of corrosion to metallic surfaces, filling gaps and openings, increasing the fatigue strength of riveted joints, to prevent entrance or exit of foreign materials to or from a sealed compartment and to provide vibration damping of panels.

TABLE II

THINNING OF FLUID RESISTANT TOPCOAT FOR SPRAYING

MATERIAL	PERCENT BY VOLUME
Fluid resistant topcoat	40
Methyl isobutyl ketone	40
Methyl-ethyl-ketone	20

Figure 1(a)

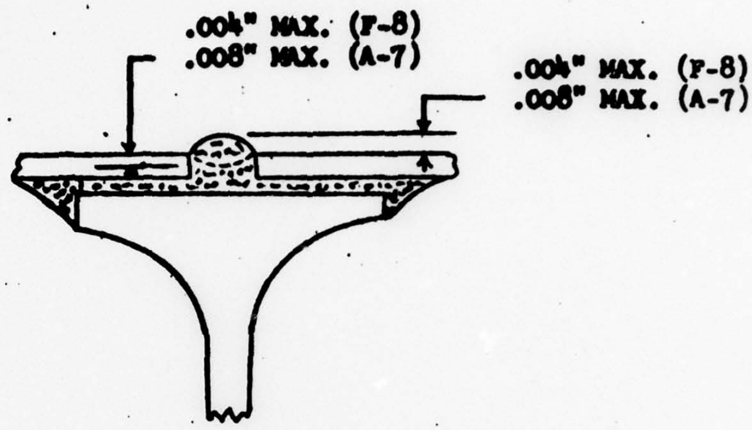


Figure 1(b)

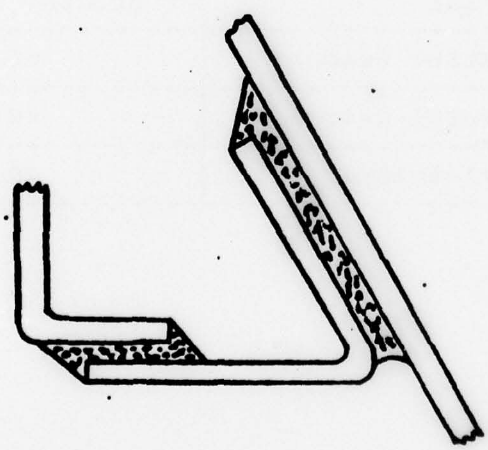


Figure 2

Typical Faying Surface Seal
(Refer to 4.5.4)

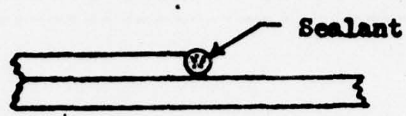


Figure 3

Applied Fillet
(Refer to 4.5.5)

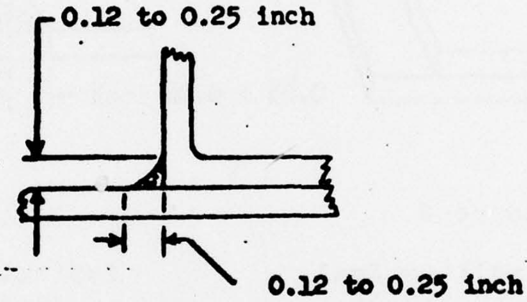


Figure 4

Typical Fillet Seal
(Refer to 4.5.5)

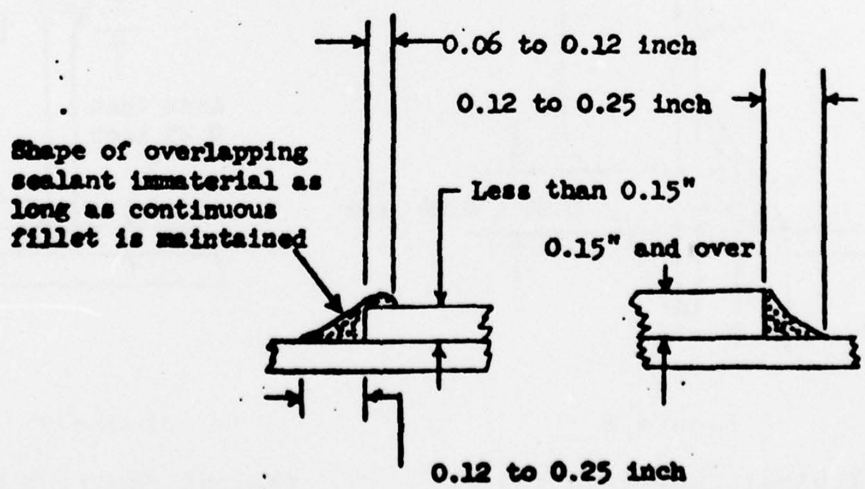


Figure 5

Typical Fillet Seal
(Refer to 4.5.5)

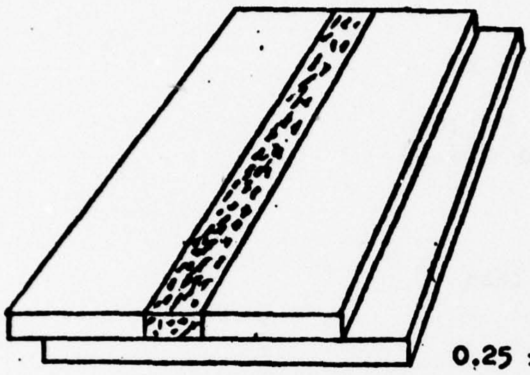


Figure 6

Typical Caulking Seal
(Refer to 4.5.6)

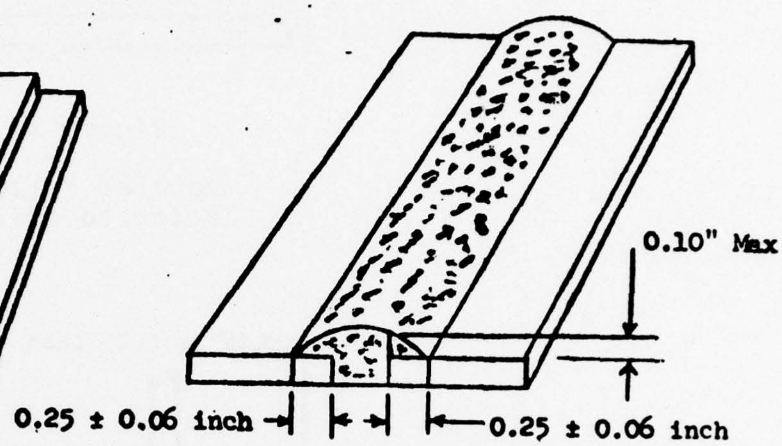


Figure 7

Typical Caulking Seal
(Refer to 4.5.6)

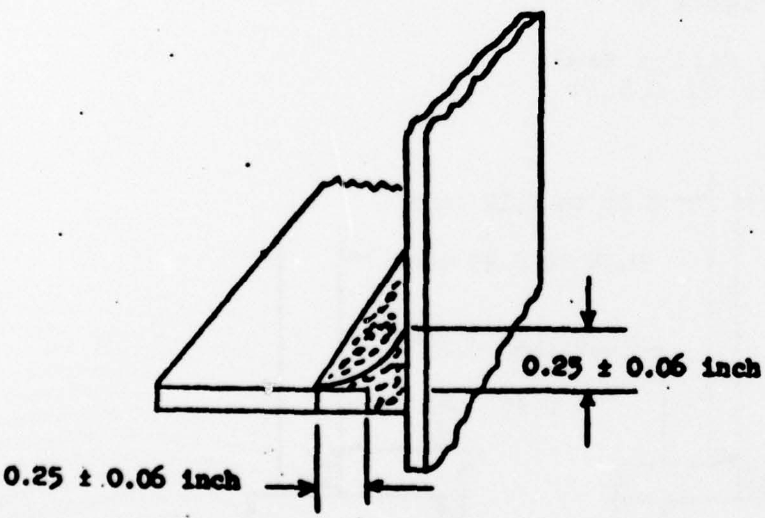


Figure 8

Typical Caulking Seal
(Refer to 4.5.6)

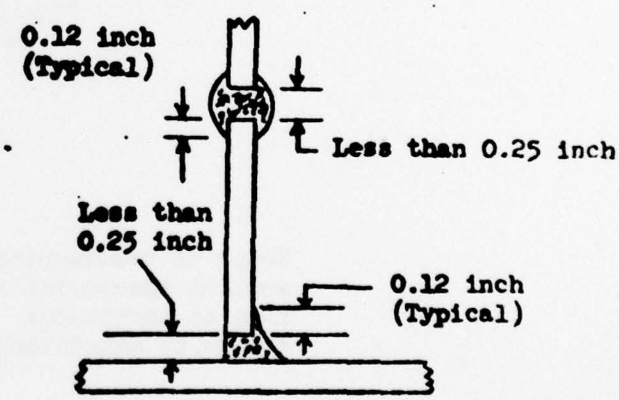


Figure 9

Typical Caulking Seal
(Refer to 4.5.6)

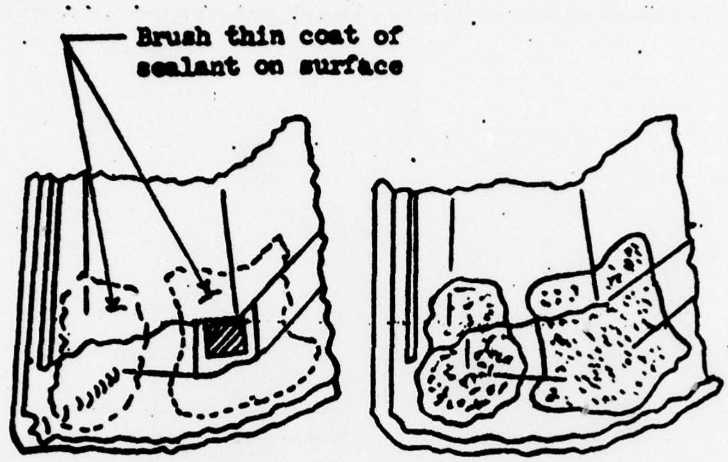


Figure 10

Typical Gusset Seal
(Refer to 4.5.7)

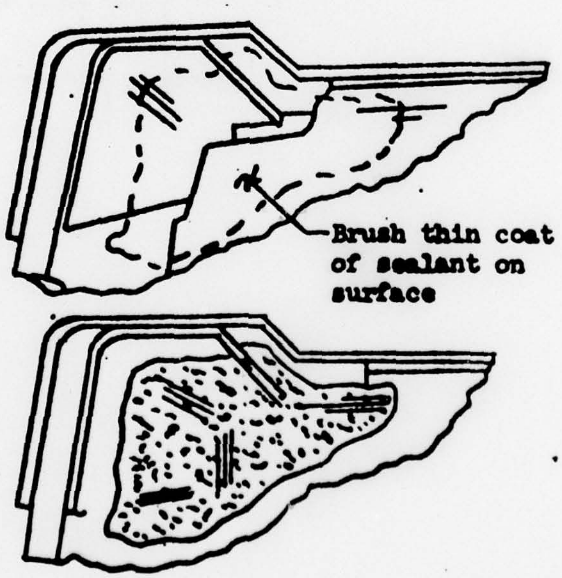


Figure 11

Typical Gusset Seal
(Refer to 4.5.7)

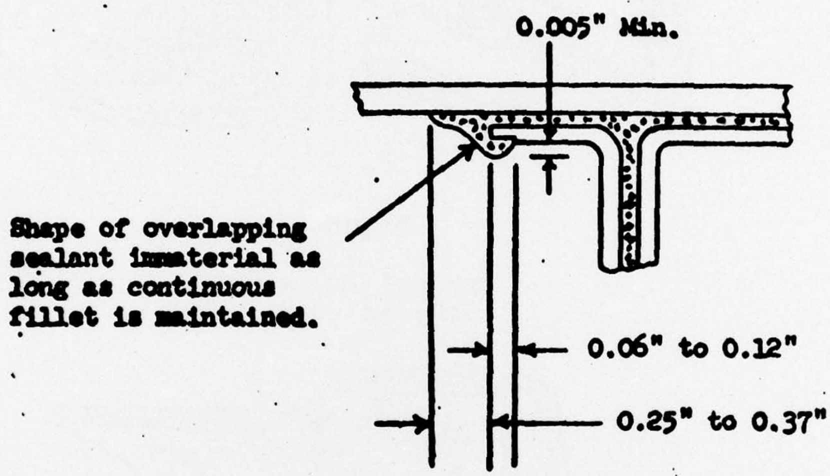


Figure 12

Typical Corrosion Protection Seal
(Refer to 4.5.11)

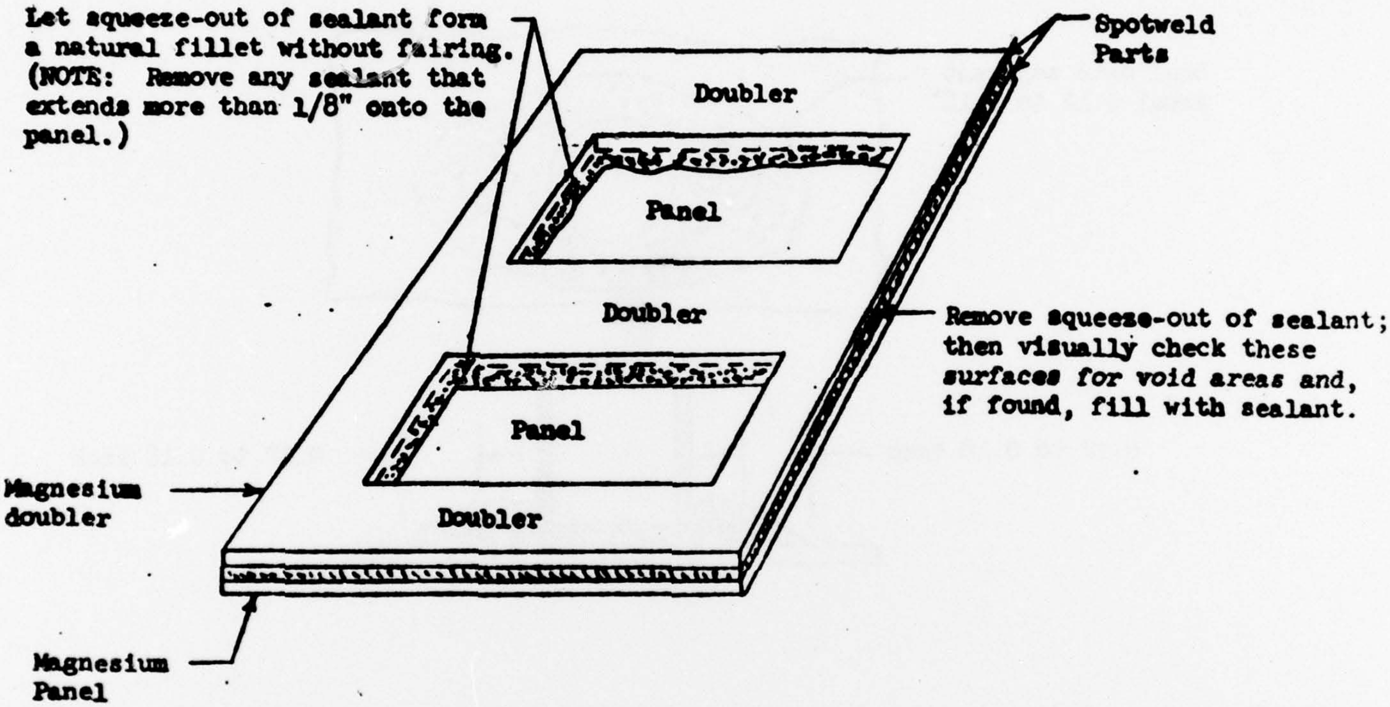


Figure 13

Typical Corrosion Protection of Magnesium Surfaces to Be Spotwelded
(Refer to 4.5.12)

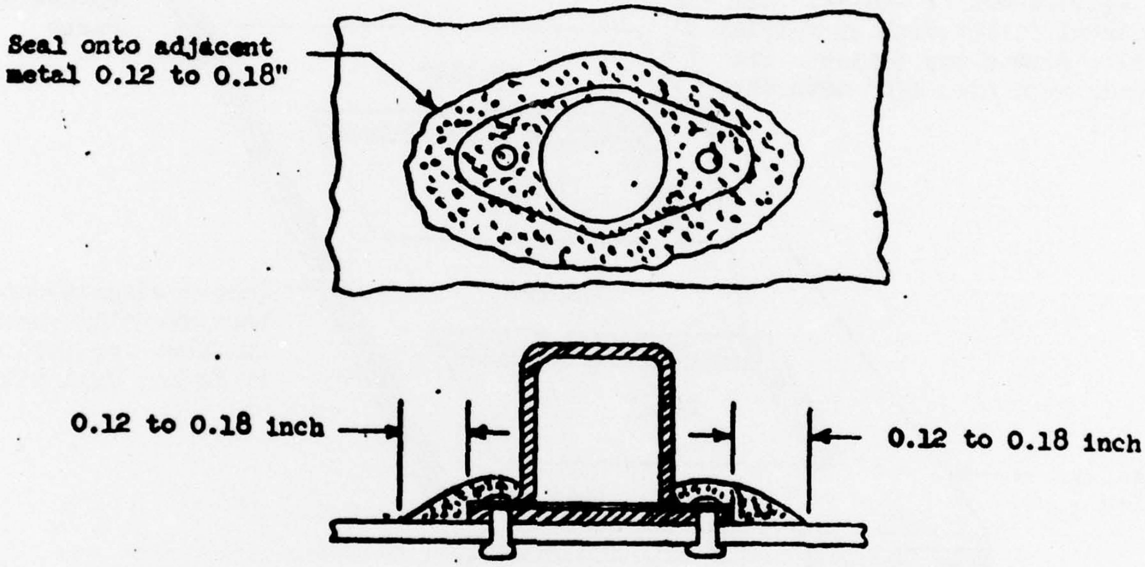


Figure 14

Receptacle Seal
(Refer to 4.5.13)

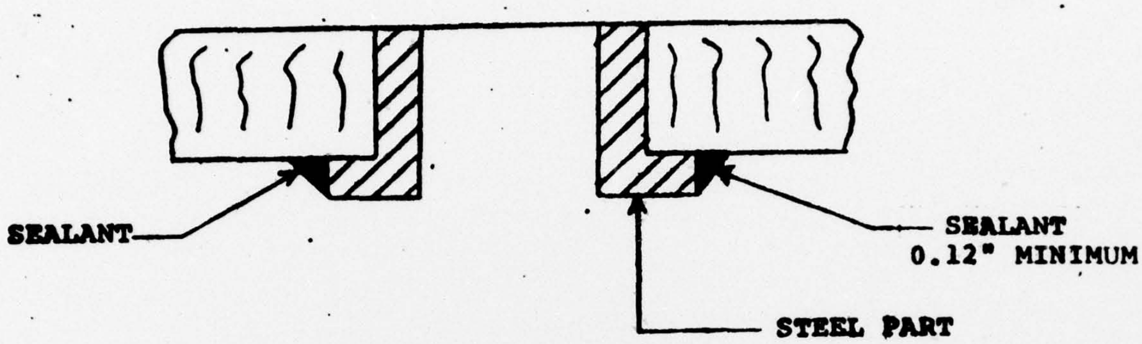


Figure 15(a)

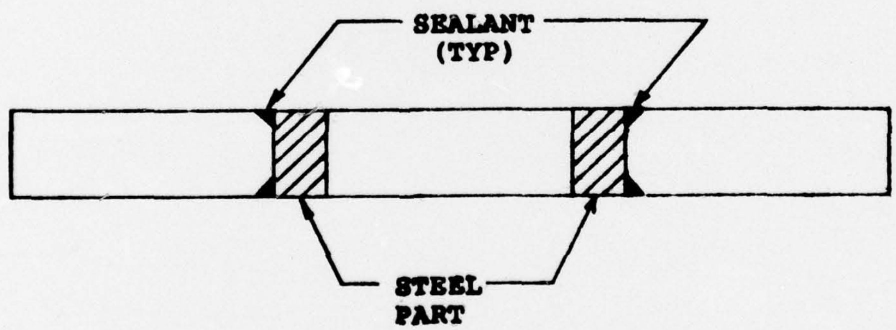


Figure 15(b)

Press Fit Seal
(Refer to 4.5.15)